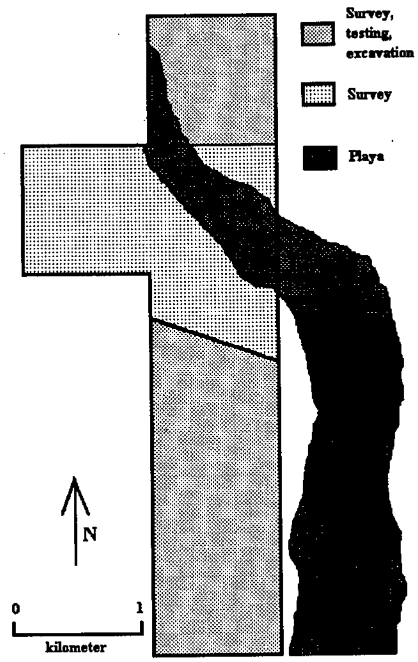
Small Sites in the Central Hueco Bolson:

A Final Report on Project 90-11

by

Raymond Mauldin
Tim Graves
Mark Bentley



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The report details the goals, methods, and results of Project 90-11, an archaeological project conducted by the Cultural Resources Branch, Directorate of Environment, Fort Bliss, Texas, to investigate small sites on the installation. Fort Bliss inventory surveys consistently record small scatters of artifacts or isolated features that lack temporally diagnostic artifacts. These small sites are ubiquitous and often account for most of the archaeolgical remains recorded. Previous surveys indicate that as many as 90% of these sites contain temporally unknown occupations. Not only is the temporal placement unknown, but an understanding of the activities conducted on these sites is lacking, as is how small sites fit into the cultural adaptation represented on the installation. The project recorded 176 sites and further investigated 89.

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EXECUTIVE SUMMARY

The "problem" of small sites in the Hueco Bolson has been debated in many forums. These ubiquitous sites number in the thousands and are the most common archaeological sites on Fort Bliss. This work represents one of the first attempts at conducting a variety of research methods to flesh out the true nature of small sites in a desert basin. While the information potential of small sites is limited by their very smallness, they still contain valuable information and can contribute to archaeological knowledge. This report also is a valuable tool in Fort Bliss' compliance with federal historic preservation law. It provides a context in which small sites can be placed in evaluating them for eligibility for the National Register of Historic Places. The authors are to be commended for finishing this large project and producing a report that is an important contribution to the archaeological record.

JAMES E. BOWMAN
ARCHAEOLOGICAL RESOURCES TEAM LEADER
FT. BLISS, TEXAS
MAY 1998

ACKNOWLEDGMENTS

As with any project of this size a number of people had both a direct and indirect impact on the final result. I will no doubt overlook some, and so apologize in advance. First among those I wish to thank are the field crews: Karen Adkins, Mark Bentley, Bruce Boeke, Paul Brothers, Mike Fisher, Tim Graves, Roger Hill, Robert Jones, Mike Kirkwood, Jeff Leach, Brian McCuller, Jim Mayberry, Mindy Melton, Robert Merrill, Val Provencio, Martha Sharp, Sue Sitton, George Tower, and Martha Yduarte. Tim Graves served as the primary crew chief during all phases of the project. He was assisted at various times by Bruce Boeke, Jim Mayberry, and Mark Bentley. Many of these same individuals were involved with the lab effort. It is not often that one gets a group of people who consistently try to do a good job. This was such a group. They all worked hard, and it was a pleasure to be associated with them.

Individuals who provided assistance with data manipulation and discussions on aspects of the project included Carlos Caraveo, Martha Yduarte, Glen DeGarmo, Galen Burgett, Glenna Dean, Chris Stevenson, Rick Holloway, Margaret Newman, Fred Almarez, Robert Hard, Susan Stratton, Pat Gilman, Tom O'Laughlin, Curtis Monger, Brenda Buck, Myles Miller, Sheila Brown, Robert Jones, Angela Linse, Bruce Boeke, Martha Sharp, Chip Wills, Jeff Leach, George Tower, Dan Amick, Karen Adkins, Mike Whalen, Roger Hill, and Paul and Susana Katz. A special thanks to everyone at Human Systems Research, Inc., especially Meliha Duran and Karl Laumbach, and to Neal Ackerly at New Mexico State University for help in tracking down radiocarbon dates.

Tim Graves, Sheila Brown, and Carlos Caraveo conducted the lithic raw material survey. Dr. Chris Stevenson performed the obsidian hydration studies. Thermoluminescence samples of burned caliche were submitted to the University of Missouri for analysis. All radiocarbon dates were run by Beta Analytic of Coral Gables, Florida.

Ms. Susan Stratton of Western Zooarcheological Research analyzed the faunal remains recovered by the project. Dr. Glenna Dean of Archeological Botanical Services and Dr. Richard Holloway of Castetter Laboratories at the University of New Mexico provided flotation and pollen analysis. Thomas O'Laughlin of Jornada Anthropological Research, provided wood identification information from project features. Dr. Margaret Newman of the Laboratory of Archeological Science, University of California at Bakersfield, identified blood residue on a sample of lithic artifacts.

Tim Graves compiled much of the environmental and excavation data and Mark Bentley prepared all the site maps and much of the survey data. Both Tim and Mark did extensive editing of data files and Tim, with the assistance of Martha Yduarte, generally kept me organized. This was not an easy task. I can now finally throw away all those notes labeled, "do not loose." I thank them for their efforts.

After much of this report was completed, I came across a publication by Doleman et al. (1991) that mirrors some of the results of this work. Because those volumes were published in 1991, this important work is not referenced as often as it should be in this manuscript. This project was completed in 1993, and a draft prepared in January of 1994. Between the date of that draft and this publication, many projects have been conducted that are not referenced or discussed here. Several of those support the suggestions made in Chapter 14.

Finally, thanks to Carrol Hedrick, who edited the report and did the final document production.

RAYMOND MAULDIN
MARCH 1998

Chapter 1

INTRODUCTION

This report details the goals, methods, and results of Project 90-11, an archaeological project conducted by the Cultural Resources Branch, Directorate of Environment (DOE-C), Fort Bliss, Texas. The project investigated small sites in a 6-square-kilometer area of the 4,500-square-kilometer installation. In accordance with cultural resource management legislation, archaeological surveys have been conducted on the 1,500 square kilometers used for military maneuvering (DeGarmo 1983). Results of those surveys suggest that the area covered by the military boundaries was popular in prehistory and that an estimated 100,000 archaeological sites may exist on the installation.

Fort Bliss inventory surveys consistently record small scatters of artifacts or isolated features that lack temporally diagnostic artifacts. These small sites are ubiquitous and often account for most of the archaeological remains recorded. One survey of more than 990 square kilometers recorded nearly 6,000 sites; 86 percent lacked temporal diagnostic artifacts (Carmichael 1986). When Carmichael's limited scatter occurrences, artifacts, and burned rock, which DOE-C defines as sites, are included, the percentage of temporally unknown occupations increases to more than 90 percent. Most of the temporally unknown sites are small, generally less than 1,000 square meters in area. Whalen (1977, 1978), who conducted earlier surveys on the installation, also recorded many small sites that he could not assign to any temporal category.

Not only is the temporal placement unknown, but an understanding of the activities conducted at these sites is lacking, as is how small sites fit into the cultural adaptations represented on the installation. This is not a unique situation. Similar small sites are common throughout the southwestern United States. No one seems to know what to do with them, although several (for example, Fish et al. 1990; Roth 1989, 1992; Upham 1984; Waters and Woosley 1990) have tried to integrate them into a larger temporal adaptive framework.

Taking a traditional approach, many researchers suggest that some small sites represent distinct components (for example, logistical gathering camps) generated by populations of the more sedentary pithouse or pueblo sites (Carmichael 1981; Ward 1978; Whalen 1980, 1986). Others suggest that the small sites are distinctly separate from larger pithouse and pueblo sites (Carmichael 1985; Kauffman and Batcho 1983; Upham 1984). They argue that these occupations are the result of hunter-gathers living cheek and jowl with the sedentary farmers of the larger sites. Carmichael (1986) argues that the small occupations may be the result of pendulum movements between a farming economy and one based on hunting and gathering, with the shifts primarily related to changing climates.

Notions of fluctuating or divergent adaptations are widely applied in the literature to account for small sites (Stuart and Gauthier 1991; Upham 1984). Although many argue the role of these occupations in the prehistoric sequence, methods for distinguishing the various site types are not well developed. Most and Hantman's (1984) research on distinguishing patterns in lithic assemblages at sites generated by differing adaptive patterns is one attempt to develop expectations in the archaeological record.

Much of the data that focuses on small sites comes from survey. In the greater Southwest, as in the Jornada region, surprisingly few sites have been excavated. Whalen (1980, 1986) was among the first to attempt a systematic investigation of small sites in the Jornada region.

In short, not much is known about small sites, either in the Southwest, in the Jornada region, or on Fort Bliss. What is known, primarily from surveys, is that they are abundant. Project 90-11 was an attempt to increase the understanding of what these occupations represent. This increased understanding will translate into more effective protection and investigation procedures for this understudied class of archaeological phenomenon.

Project 90-11 involved surveying 6 square kilometers in the central Hueco Bolson (Figure 1.1), an intermontane basin that is an important training area for armored cavalry and air defense artillery on Fort Bliss. Surface collection and testing of selected

areas followed the survey. The project was conducted according to procedures developed in the Fort Bliss Historic Preservation Plan. The Directorate of Environment, Fort Bliss, Texas, curates all project records, notes, photos, and collections.

Project 90-11 consisted of four phases. Phase 1, survey of the 6-square-kilometer project area, took approximately 107 person days, with about 40 percent of the time devoted to field survey. Phase 2 consisted of surface collecting and testing sites on 3.45 square kilometers within the larger 6-square-kilometer area. About 1,565 person days were spent on this phase, with approximately 80 percent of that time in the field. The high percentage of field-to-laboratory time was a result of the low numbers of lithic and ceramic artifacts collected in the project area. Phase 3 involved excavation of selected areas within the project and the lab effort. Project personnel expended about 1,125 person days on this phase, with about half the time spent in excavation. The final phase of the project, Phase 4, involved syntheses of data and production of this report.

The project recorded 176 sites and further investigated 89 of them in Phases 2 and 3; no work beyond survey was conducted on the other 87 sites, which are in the central survey area. Of the 89 investigated sites, the research potential of 37 was exhausted. Thirty-five have important data remaining and provisions should be undertaken to protect them from significant impact. Additional testing is necessary to determine the research potential of the remaining 17 sites. Most of the northern 1-by-1-kilometer grid quad was exhausted, clearing most of it for military use. Although the project exhausted the research potential of certain sites in the southern parcel, sites with significant and potentially significant data remain throughout the 1-by-2.45-kilometer area.

Research Design

The archaeological research questions that guided Project 90-11 were relatively simple: (1) What activities formed the sites? (2) What are the dates of small sites? (3) What is the correlation of small sites to each other and to larger, better documented sites in the region? Research also was designed to answer two management questions: (1) Are there different kinds of small sites in terms of temporal, functional, or adaptational components that should be incorporated into a protection strategy? (2) How can recognition and testing strategies on small sites be improved?

At the start of the project, the questions made sense. They seemed to be a reasonable, straightforward way to proceed. It soon became apparent that they often made no sense. When they did, they were being asked at the wrong spatial scale or the methodological tools to unravel the answers were lacking.

During the Phase I survey portion of the project it became obvious that what were initially believed, based on previous surveys and field reconnaissance, to be "small" sites—200 to 300 square meters—could be transformed into sites of more than 50,000 square meters by altering the survey intensity. It also became apparent that erosion and deposition often determined site definitions, as well as intrasite patterns in artifacts and features. After testing, some sites with less than 100 artifacts spanned several millennia, and other sites with multiple features in the same temporal span had less than 10 artifacts. Frequently, features dating well into the Formative period had no ceramics. Sometimes well-dated clusters of features contained no artifacts.

Upon completion of artifact and feature analyses, significant differences existed between artifact assemblages from the surface and those from excavation. The differences were primarily in size, with larger items dominating the surface assemblages. These differences rendered comparison of material type, artifact type, or assemblages at a site level untenable unless comparing only surface material or only excavated material.

Traditional questions that guided the initial research—questions that treated sites as observational, management, and analytical units with some potentially discrete behavioral implications—are not appropriate in this context. In fact, they may not be appropriate in most contexts. This is not to argue that sites, as defined by the concentration of artifacts at some arbitrary density and/or features on the landscape, do not exist. Clearly, they do. As a component of a management strategy, sites are the leitmotifs of the cultural resource world. They will remain so. However, sites, whatever the definition, do not necessarily reflect past behavior directly, nor do they

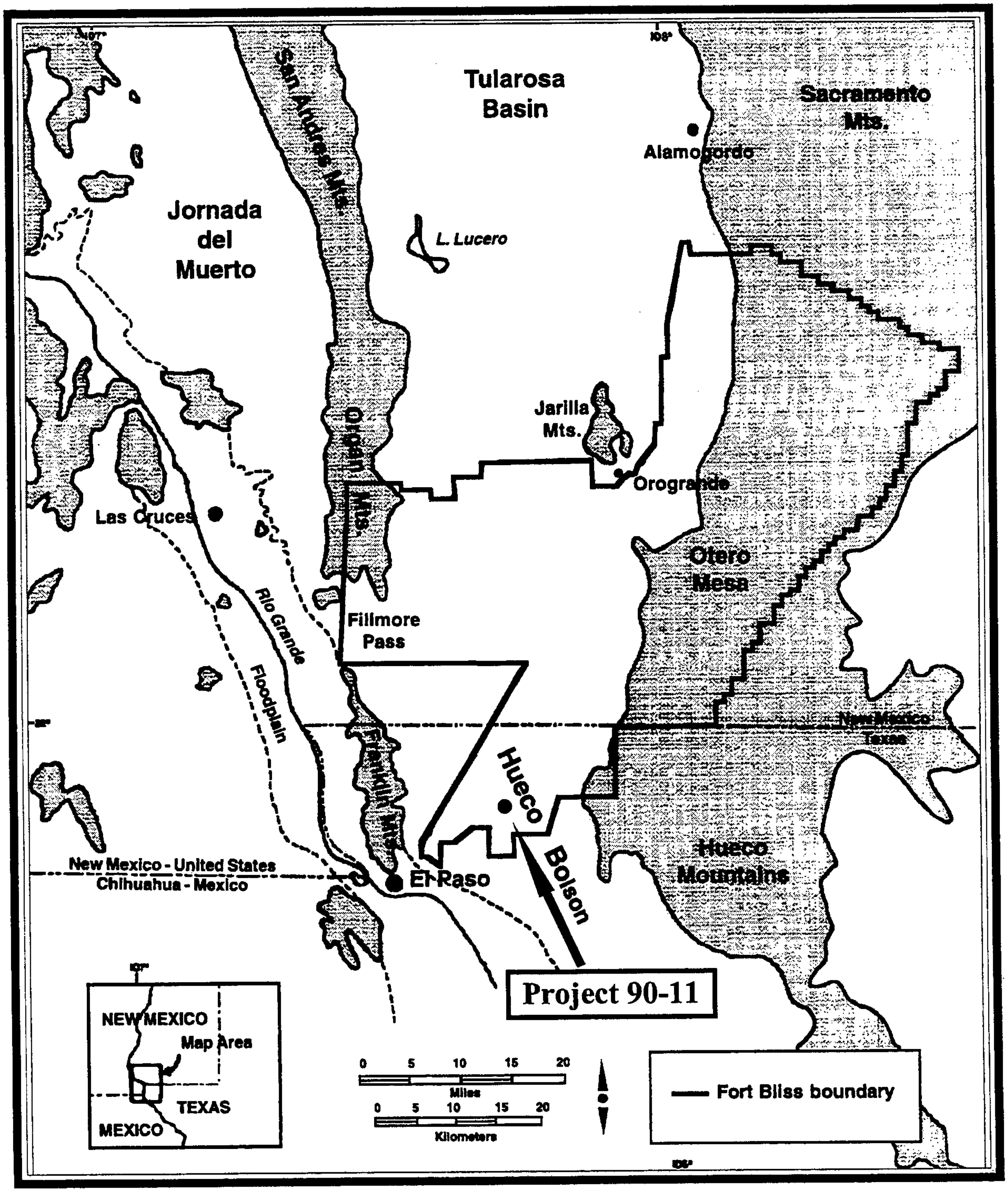

Figure 1.1. Jornada Mogollon Area of Southern New Mexico and West Texas. The Project 90-11 area is in the central Hueco Bolson on Fort Bliss Military Reservation.

reflect the entire range of behavior. They are complex combinations of artifacts and features. Some of these artifacts and features probably are associated in a behavioral and organizational sense, and some have no relationship to one another.

It is possible to imagine situations where sites form discrete clusters of artifacts and features—all related to specific activities conducted at specific times in the contexts of specific adaptations—unaffected by subsequent reuse or modification of the same area. It is also possible to imagine many other, and equally improbable scenarios. Imagining them does not make them real. The reality is that all sites simply represent areas of higher artifact densities on the landscape that may be the result of multiple activities conducted by different adaptive units over unknown time spans.

Clusters of artifacts and/or features occur at certain locations as the result of a variety of processes. Some are the result of the way the archaeologist looks at the record (for example, survey intensity, site definitions); others are the result of natural processes (for example, erosion, deposition) or related activities conducted at a location. They also represent changing strategies of land use that can deposit different sets of artifacts in the same place. Sites are affected by scavenging behavior. They may be reoccupied for different activities and reoccupied for the same activities. If the goal is to understand variability in the archaeological record, it will not be accomplished either by assuming that all clusters are understandable as discrete occupations or by suggesting that they are distorted palimpsests and therefore useless. Rather, what is needed is investigation of the processes that are conditioning the archaeological record.

These observations have substantial implications for the analytical units used to consider the archaeological data. Most analyses in this report are at the project level, with comparisons at a regional scale where data is available. Some comparisons are made at a landform level. Smaller levels of analyses include comparisons of areas of higher artifact concentrations and features within sites on the surface and between excavation areas with large horizontal exposure and associated artifacts. Intersite comparisons are not made; sites were defined for management purposes and not as units of analysis. Yet, management considerations and decisions on what to test, evaluate, and protect were conducted on a site-by-site basis. Site level data, however, should not be confused with analytical units. In this report, *site* refers to a collection of artifacts and features on the landscape. No temporally discrete behavioral, organizational, or functional component is intended, nor should any be assumed.

Archaeological Questions

The first major research question deals with site function. What activities were conducted at the site? Although the project explored several avenues, the answer remains unknown. The question is believed to have been poorly phrased because the site level is not the appropriate analytical scale for this kind of investigation.

Project results for the second research question, chronological contexts, are intriguing. It appears that different chronological techniques picked up different aspects of behavior, one associated with the production of features and one with the generation of artifacts. Radiocarbon dates on 61 features in the project area suggest a principal use of the study area during the late Archaic and into the early Formative period. A sample of more than 100 radiocarbon-dated features from this and other projects in the Hueco Bolson documents increasing use beginning after 3200 B.P. and peaking around 1350 B.P. After this period of peak use, the frequency of feature dates—and by extension, features—drops rapidly. Few hearths are later than 1050 B.P. According to regional survey data (Carmichael 1986; Whalen 1978) this was the time when regional population densities were at a peak. Yet, judging by the radiocarbon dates, the Hueco Bolson or central basin was all but abandoned during this period.

Based on 471 radiocarbon-dated features in the Jornada area, all of which are tree-ring calibrated, regional patterns and those of the central basin are quite different. Although both increase similarly, regional patterns suggest much later use with a peak at roughly 900 B.P. This peak is much more in line with the general cultural-historical sequence and suggests that the central basin pattern of a dramatic decrease in features after 1350 B.P. represents a significant departure from the traditional culture history sequence.

The pattern of feature dates becomes even more interesting when compared with results of obsidian hydration, the other major dating technique used by the project. The use of obsidian hydration in the Jornada has a long and painful history (Miller 1990),

much of which is associated with dates provided by experimentally induced rim rates. This project used a different approach of constructing a rate of development by regression analysis. A few samples from locations that have both radiocarbon and obsidian hydration rim readings were used to construct a rate of rim development. The resulting equation was used to calibrate 146 obsidian rim dates from Project 90-11, as well as an additional 131 rim readings from other sites on Fort Bliss. To assess the reliability of the obsidian dating technique, regression dates were compared with radiocarbon dates. With a few minor differences, the two independently derived regional curves were surprisingly, and encouragingly, similar, suggesting that the obsidian dates are reasonable approximations of "true" dates.

When obsidian dates from the project area are compared with radiocarbon dates from the central basin, the obsidian dates are much later. In contrast to the feature pattern where the central basin had decreasing use after 1350 B.P., obsidian dates suggest a continuing use with a peak at approximately 750 B.P. Limited data on projectile point styles that suggest some late use of the central basin support the difference. The two dating techniques pick up different behavioral patterns, one associated with feature production and one with generation of artifacts; the latter generally does not involve features. The pattern has importance for the third major research topic addressed in this report, identifying the adaptive roles of occupations in the central basin, or how the occupations fit together in the overall adaptation.

Project personnel compared the number of artifact types and the total number of artifacts in an attempt to identify patterns of activity. At smaller, intrasite levels, these patterns reflect two assemblages. One pattern or assemblage fits predictions for task-specific occupations and the other, more common, pattern suggests high variability. The types of feature and artifact densities represented in intrasite comparisons are well within the type and density of remains in ethnographic examples of residential sites used by mobile hunters and gatherers.

Residential use of the central basin—that is, use of a location by most members of a family group for some time—may have generated many feature dates and an unknown proportion of artifacts. Ethnographic examples of residential occupations range from the ephemeral remains of the !Kung of southern Africa or the Apache of the southwestern United States to permanent year-round settlements. A pattern similar to the former is possible for the project area. On most sites, structures were not identified. In addition, middens were completely absent, and most sites had few artifacts. Yet, these kinds of remains are quite similar to residential occupations left by high mobility hunter-gatherers. This is not to argue that the intrasite concentrations of artifacts and features in the project area are just like the !Kung or Apache. The point is that the remains uncovered on Project 90-11 are compatible with the remains generated by known cases of short-term residential occupations.

This pattern of high mobility residential use could be responsible for the generation of some occupational debris collected on the project and may be associated with most of the feature dates. This is a hunter-gatherer adaptation. In the opinion of the authors, there is no evidence that this hunter-gatherer adaptation is quantitatively different from others in the region at the time. Also, there is no evidence that it reflects a different adaptive strategy or major fluctuation in economic orientation.

The pattern of residential use—if it does account for some adaptations reflected in small sites—changed about 1350 B.P. when feature dates started to decline; by 700 B.P. use of the central basin was qualitatively different. The remains left behind by the later adaptation manifested by a low density of scattered debris across the landscape are considerably different from the first. The authors interpret this as an increasing use of the central basin as a foraging zone for resources, probably on a daily basis, and propose a shift from the use of the area mainly for short term residences to one in which the area became a resource extraction zone, probably used by foraging groups from residential locations primarily outside the basin.

Why did this shift occur, if, in fact, it did? The answers may be related to changes in subsistence and mobility systems at a regional scale and/or a shift in the climate. Although this report explores both patterns, sufficient data to exclude either possibility is lacking.

Management Implications

To apply this research to a more effective management effort, several implications—both for considering the scenario outlined above and for investigating small sites in the future—are suggested:

(1) a revision of survey and recording techniques will be necessary, (2) minimally, a resurvey of selected parts of the areas used for active maneuvering should be conducted, and (3) arbitrary definition of what constitutes a site should not be confused with either analytical units or protection strategies. A series of steps is outlined that may result in more effective management of both the lower visibility archaeological materials that are so prevalent on Fort Bliss and the higher visibility sites.

Report Outline

Chapter 1 provides an introduction to Project 90-11 and summarizes its goals and major accomplishments. Chapter 2 places the project in a regional setting, outlining aspects of the regional and project-specific environment, and Chapter 3 discusses the cultural history and adaptive models developed for the various periods. Chapters 4 through 6 discuss survey methods and results (Chapter 4), surface collection (Chapter 5), and testing and excavation (Chapter 6). Chapters 7 through 9 provide detailed analyses of ceramics (Chapter 7), lithics (Chapter 8), and features (Chapter 9). The analyses discussed in Chapters 10 through 13 are used to consider research and managerial contexts. Chapter 10 discusses data relevant to site function. Chapter 11 describes chronometric results, and Chapter 12 investigates adaptive roles. Chapter 13, which wrestles with management problems and prospects, suggests major revisions to the current district level protection strategy. These revisions are an outgrowth of patterns identified in previous chapters. Finally, Chapter 14 provides a brief summary of the project results.

The appendices provide specialized analyses of specific aspects of the project. Appendix A summarizes historical artifacts recorded on the project, and Appendix B summarizes the survey data for sites outside the primary project area. Appendix C summarizes the sites, including information on dating, site size, degree of erosion, number and types of features, and amount of testing. Each site description contains a site map of the surface showing the location of features, dunes, and modern activities such as roads and trails. A second map defines locations of testing and excavation conducted at the site level. Appendix D describes backhoe work conducted on sites. Appendix E lists artifacts recorded on each site, and Appendix F lists information on isolated artifacts. Appendix G provides data on tested and excavated features.

Appendix H discusses identification of blood residue on a sample of lithic artifacts. Appendix I presents analysis of faunal remains recovered by the project. Appendix J summarizes data from a series of experiments conducted on hearthstones. Appendix K and Appendix L present the results of flotation and pollen analysis. Appendix M provides wood identification information from project features. Appendix N provides a list of radiocarbon dates for the project; Appendix 0 presents the results of the obsidian hydration studies, and Appendix P provides regression dates on obsidian. Appendix Q describes thermoluminescence samples of burned caliche submitted for analysis. Although the results of the analysis were not available at the time the report was prepared, these samples are from well-dated contexts and should provide an initial assessment of the utility of the technique.

Chapter 2

ENVIRONMENT

Climate

Several detailed environmental summaries of the Fort Bliss area (Bradley 1983; Fields and Girard 1983; Orton 1978; Reynolds 1956) document the warm to hot days, cool nights, and low humidity of the El Paso region. Temperatures range from a high monthly average of 35.2 C in June to a low of 13.5 C in January. The frost-free period, from late March into early November, averages 237 days a year.

Mean annual rainfall is 20.1 centimeters with more than one-half falling during the months of July, August, and September. The driest months of the year, with less than 3 centimeters of rainfall, are March, April, and May. The wettest year on record is 1884 with 46.5 centimeters and the driest is 1891 with 5.6 centimeters (Bradley 1983; Orton 1978; Reynolds 1956). Late summer thunderstorms often are intensive, highly localized events, and soil saturation commonly results in substantial runoff that, on occasion, creates standing water in some playas. Late spring and winter rainfall events are less intense than the summer thunderstorms and substantial runoff does not result.

A summary of rainfall and growing season relationships (Figure 2.1) shows that production occurs throughout the growing season, but is highest in the late summer after monsoon rains arrive. The highly localized rainfall, which is characteristic of most southwestern areas, may cause one place to receive substantial rainfall while a short distance away it remains dry, and this spatial variability results in highly uncertain food production. Although production occurs throughout the growing season it is highest in the late summer after the monsoon rains arrive.

Potential evapotranspiration averages over 200 centimeters annually, resulting in a substantial water deficit throughout much of the year (Orton 1978; Reynolds 1956). Like most desert environments, soil moisture limits energy transfer within the ecosystem and is closely tied to rainfall and runoff

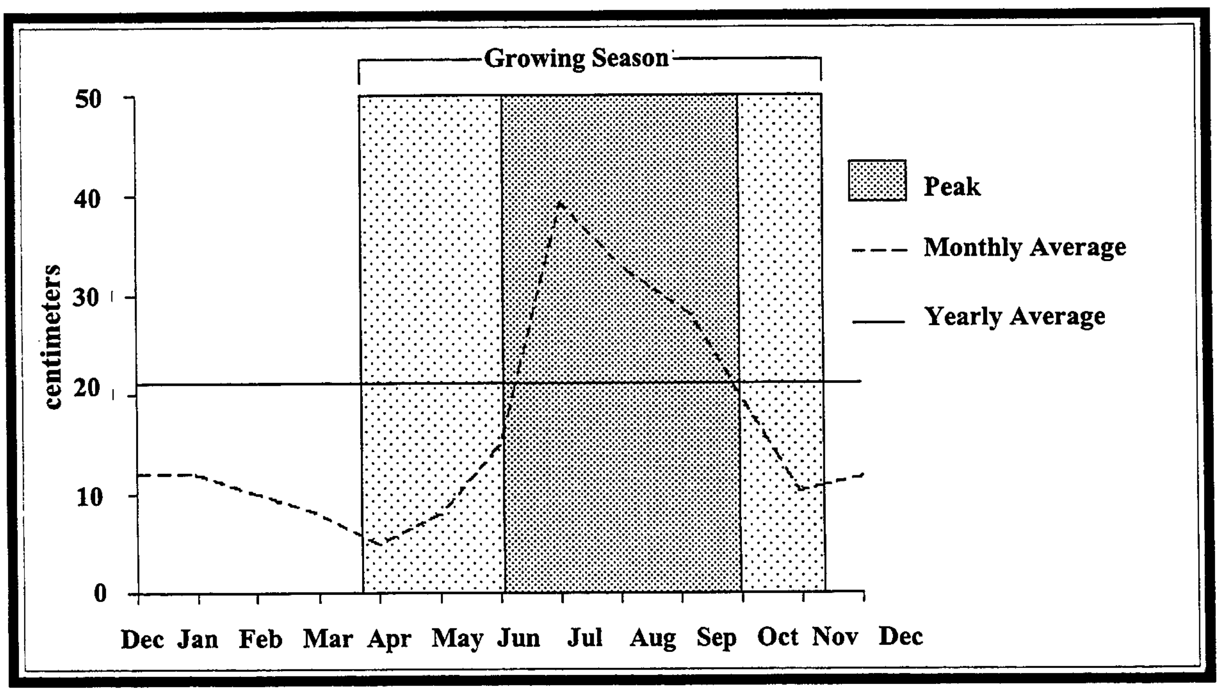

Figure 2.1. Rainfall and Growing Seasons (El Paso, Texas).

(Ludwig 1986; Noy-Meir 1973; Satterwhite and Ehlen 1980).

The major source of surface water is the Rio Grande and minor sources are springs and huecos in the peripheral mountains. The springs and huecos result from trapped or perched rainfall and snow melt that collects in the fissures and hollows of the mountains. Water sometimes ponds in playas after heavy thunderstorms but seldom lasts more than a few days.

Physiography and Soils

El Paso Region

The El Paso region lies within the Mexican Highlands section of the basin and range physiographic province (Hawley 1975). The Hueco Bolson and Tularosa Basin (see Figure 1.1) constitute an intermontane lowland formed by fault block uplifting of mountains to the west and east while the bolson was descending (Lovejoy 1980). The lowland extends from central New Mexico through far western Texas into northern Mexico. North-south trending mountain chains, including the San Andres, Organ, Franklin, and Juárez Mountains, form the western boundary, and the Sacramento and Hueco Mountains form the eastern boundary. The Quitman Mountains and Sierra de la Amargosa border the southeastern extent of the bolson. The only mountain group within the basin is the Jarilla Mountains, a small, isolated igneous intrusion near Orogrande, New Mexico.

Over one million years ago, floodwaters and alluvium from the ancestral Rio Grande flowed south and dissipated southeast of the El Paso region near Fort Quitman, Texas. Riverine sediments filled a broad basin called Lake Cabeza de Vaca, and movement of the sediments deposited sands and gravels on the desert floor in the central Hueco Bolson (Lovejoy 1980). An additional geologic event that contributes to the filling of the bolson is the ongoing erosion of the surrounding mountain chains (Knowles and Kennedy 1956).

Surface geological deposits consist entirely of Rio Grande gravels and sediments, eolian deposited sands, and gravel-to-pebble-sized caliche nodules formed within the region. Within the mountain alluvial fans along the bolson margins, runoff has transported large volumes of sediment. Conversely, on the desert floor, the primary contributors to the movement—exposure, and redeposition of recent sediments—are eolian in nature.

The Hueco-Wink association is the predominant soil, with lesser amounts of the Turney-Berino association. Soils are defined as aridisols and argids respectively (Birkeland 1984). The Hueco-Wink association, which comprises loamy fine sands over a brown and yellowish brown fine sandy loam underlain by layers of indurated caliche, is highly susceptible to eolian erosion unless protected by vegetation (Jaco 1971; Monger 1988, 1993; Pigott 1978).

The Turney-Berino association in the central basin playas contains a surface layer of light reddish brown, friable fine sandy loam over a layer of light brown, friable loam. These soils overlay a light brown, calcareous, moderately alkaline clay loam. A weakly cemented caliche is below the clay loam. Jaco (1971) notes that this soil has a high moisture content and moderately slow permeability (see also Monger 1993; Satterwhite and Ehlen 1980).

Project Area

Elevation ranges from 1,210 to 1,230 meters in the project area, which is dominated by mesquite-stabilized coppice sand dunes. The dunes range in height from 1 to 6 meters and often are linked by moderately built-up sheet sands that average 1 meter thick. The lower, interdunal areas are deflated and occasionally contain calcium carbonate nodules or exposed caliche; formation of the dune and blowout topography depends on wind and the degradation of vegetation.

Most of the surface soils in the southern part of the project area are torripsamments, and the northern square-kilometer area contains exposed surface calciorthids and torripsamments (Pigott 1978). The playa east of the southern part of the project area contains aquic calciorthids soils, which should have a slightly higher moisture holding capacity.

The eolian surface sand is friable and light brown (7.5YR6/4, Munsell) in color. It ranges from several centimeters to over 1 meter thick and occasionally disappears entirely. This soil contains little organic matter. A buried *A* horizon of loamy dark brown to brown sand (7.5YR3/4 to 4/4) rarely exceeds 30 centimeters thick and is highly localized, occurring in isolated patches throughout the project

area. It is often found in or near mesquite sand dunes and may be associated directly with decayed organic matter from a dune (Monger 1988). However, it also occurs in nondune settings, suggesting that the dunes may be protecting the horizon from erosion.

Frequently underlying the *A* horizon, or being directly under the dune sand when that horizon is not present, is a reddish brown to brown sand (7.5YR5/6). This stratum occasionally contains caliche filaments and can range from 10 to 90 centimeters in depth within the project area.

An indurated calcic horizon is found at various depths below the current surface. The soil is occasionally visible at the surface between dunes in blowout areas and generally lies from 20 centimeters to over a meter below the present ground surface.

Flora and Fauna

A variety of flora and fauna, much of which prehistorical inhabitants may have used, is present in the El Paso region. Several authors (for example, Anderson 1993; Hard 1983a; Mauldin 1993a; O'Laughlin 1978) provide detailed summaries of the potential periods of availability of these resources.

The major animal resources include mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), cottontail (*Sylvilagus auduboni*), jackrabbit (*Lepus californicus*), and a variety of small rodents and reptiles. Floral resources, which have potential uses for food, fiber, and wood, include lechuguilla (*Agave lecheguilla*), sotol (*Dasylirion wheeleri*), mesquite (*Prosopis juliflora*), yucca (*Yucca elata*), sage (*Artemisia filifolia*), snakeweed (*Xanthocephalum Sarothrae*), creosote (*Larrea tridentata*), allthorn (*Koeberlinea spinosa*), and various grasses and forbs.

Paleoenvironment

Region

Limited information on paleoenvironmental climate and vegetation in the El Paso region comes primarily from pack rat middens in the Hueco Mountains, about 20 kilometers east of the project area, and pollen work. Pack rat midden studies in the Sacramento Mountains to the north, ^{18}O and ^{13}C ratios in soils on Fort Bliss, tree-ring data from the Organ and Sacramento Mountains and Chupadero Mesa, and general southwestern climate literature supplement these data. The primary periods considered in this report are the Middle and Late Holocene (8000 B.P. to the present).

For the Middle and Late Holocene, most data suggest a warm, probably dry period between roughly 7500 and 4500 B.P. An essentially modern climate characterizes the remainder of the sequence, with the possible exception of a period between roughly 3000 and 1500 B.P., when some data suggest a mesic interval may have occurred. The complete dominance of desert shrub plants probably is related to the introduction of large herds of cattle in the late 1800s. However, considerable evidence suggests a period of aridity and a shift to desert shrub vegetation as early as the Middle Holocene (Van Devender 1990; Van Devender and Spaulding 1979).

The Middle Holocene appears to have been warm and dry. Evidence for such a climate between about 7500 and 4500 B.P. comes primarily from general southwestern pollen studies, coupled with pack rat midden studies, isotope analysis in the El Paso area, and geomorphic studies in the El Paso area and southern plains. This warm, dry period probably corresponds to Antevs (1954) Altithermal. Benedict (1979) suggests that the Altithermal was widespread in the western United States and probably consisted of two droughts, the first between 7000 and 6000 B.P., and the second in the 6000 to 5500 B.P. interval.

Martin (1963) questions the Altithermal as a warm, dry period suggesting that much of the southwest was warm and wet. This interpretation, based on pollen sequences from the White Water Draw region in southern Arizona, is somewhat supported by Van Devender's (1990) interpretation of pack rat midden data. However, as Hall (1985), Haynes (1968), and Waters (1986) demonstrate, the sequence that Martin used to make this interpretation lacked the critical Middle Holocene deposits, which resulted from erosion. Consequently, Martin's original characterization is probably inaccurate, though it remains widely cited in southwestern literature.

Hall (1985), in a review of southwestern pollen studies, notes abundant evidence for a dry Middle

Holocene. Holliday (1989) using geomorphic and palynological evidence, supports Hall's interpretation and marshals various lines of evidence suggesting that the southern High Plains about 300 kilometers east of the current project had a warm, dry climate during the Middle Holocene (see also Johnson and Holliday 1986). His data suggest dune formation may have occurred between 6000 and 4500 B.P. in conjunction with widespread erosion.

Monger (1993) describes the geomorphology of the El Paso region with detailed attention to paleoclimatic evidence that supports the warm, dry Middle Holocene scenario. Following Gile and Hawley (1968), he convincingly argues that the last onset of alluviation, the Organ sediments, began about 7000 B.P. and was tied to decreased vegetation cover, probably related to increased aridity. Monger (1993) reports inorganic radiocarbon dates on calcium carbonate nodules from several locations that date to 9000 B.P., which suggest that nodules were forming around that time. The nodules are now in a lagged context, suggesting that sometime after 9000 B.P. a major erosional event removed the sediments associated with the nodule development.

Monger (1993) also reports stable carbon and oxygen isotope ratios for a series of profiles in alluvial fans and the central basin. Although direct interpretation of isotopic temperature (^{18}O) and vegetation (^{13}C) patterns are difficult, he demonstrates a dramatic shift in ^{13}C ratios from a predominately ^{4}C photosynthetic pathway (for example, grasses) to a ^{3}C pathway (for example, mesquite, creosote) in the alluvial fan environments about 8000 B.P. Given the temporal scale, such a shift fits well with the with the theory of a warm, dry Holocene. However, the ^{18}O isotope ratios show no dramatic temperature change during the Holocene-Pleistocene boundary and no evidence for a temperature change during the glacial maximum (ca. 18,000 B.P.). Thus, either no temperature change occurred or the oxygen isotopic signatures from the fans are not accurately recording temperature changes during this period.

Stable isotope data from the central basin shows a greater variability through time than the isotopic ratios from the fan sediments (Monger 1993). Monger suggests that this variability may be caused by contamination of sediments by older carbonate dust. Nevertheless, the shift from a dominate ^{4}C vegetation pattern to the ^{3}C pattern at about 8000 B.P. is evident. Unlike the fan settings, the ^{18}O ratios show a dramatic increase in temperature after 16,000 B.P.

Late Holocene data from pack rat middens throughout the southwestern United States and northern Mexico suggest development of essentially a modern climate (Betancourt et al. 1990). In the Hueco Range pack rat data dominated by xeric species suggest that Chihuahuan desert plants occurred after 4200 B.P.

Support for a brief wet and cool period between roughly 3000 and 2000 B.P. comes primarily from pollen studies to the north of the El Paso area, local isotope data, and the Sacramento pack rat midden data. Pollen studies in Arizona, New Mexico, and southern Colorado suggest increased abundance of pinyon and pine pollen after 3000 B.P. This includes the Chacoan sequence circa 2400 B.P. (Fredlund 1984; Hall 1985) and pollen sequences from 4700 to 2800 B.P. in southern Colorado (3000 B.P.) and the White Mountains in Arizona (Hall 1985; Maher 1972, 1973). Bachhuber (1982) reports a resurgence in lake levels in the Estancia Basin between about 3000 and 2000 B.P., and Hevly (1980) notes increased pine in the San Augustin Plains during this 1,000-year period.

Local data also suggest a more mesic period during this interval. Pack rat sequences from the Hueco Mountains (Van Devender 1990) document the return of pinyon, along with oak and juniper, about 2600 B.P. (Figure 2.2). Although pinyon does not occur after that date, oak is present in a pack rat midden dating about 1500 B.P. and juniper is present in middens dating between 2500 and 1500 B.P. During this period, sotol, ocotillo, and creosote are not common. The pack rat sequence for the Sacramentos has pinyon, after a substantial absence, at 2300 and 1700 B.P. Oak also is present at 1760 B.P. in the Sacramento Mountains. Van Devender (1990) suggests that the late occurrence of pinyon and oak in both the Sacramento and Hueco Mountains and the occurrence of juniper in the Huecos may represent contamination, but proposes no evidence to support this position. The occurrence of these species in both sequences at about 2500 B.P. and 1500 B.P. and the lack of several prominent xeric species in the Hueco sequence may indicate a cooler, wetter climate during this period.

Freeman (1972) notes an increase in grass pollen sometime after 4700 B.P. in southern New Mexico (see Cully and Clary 1980; Hall 1990;

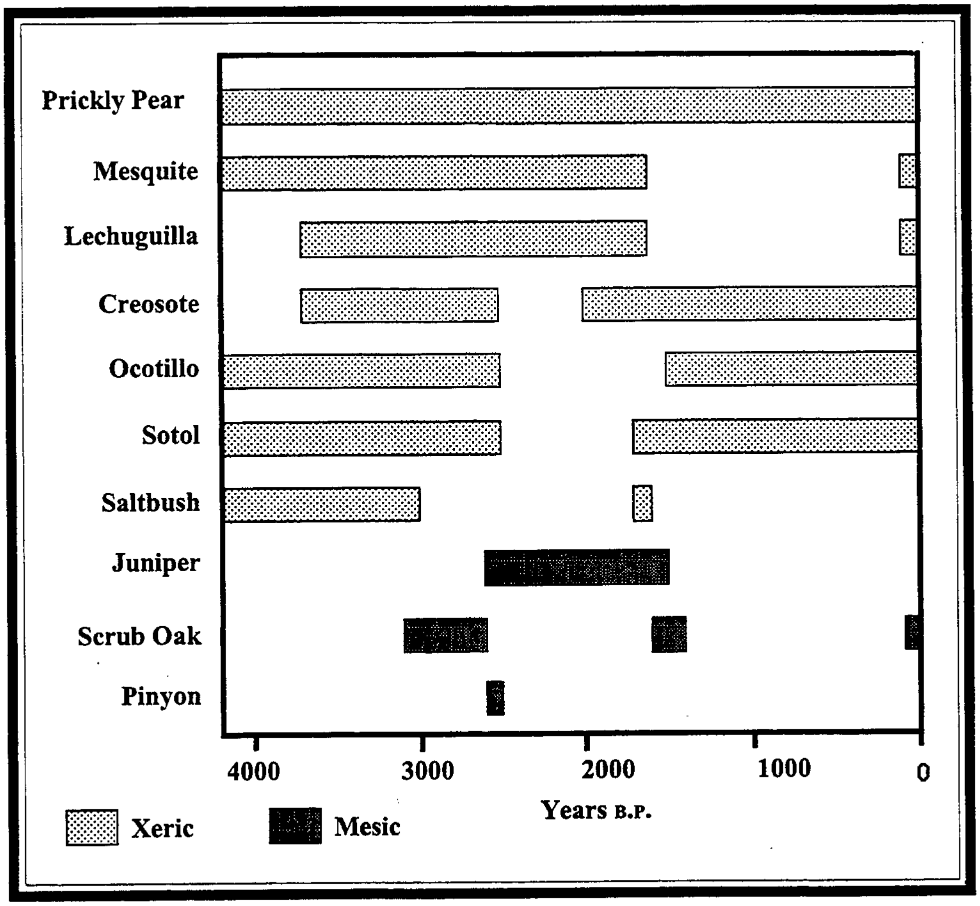

Figure 2.2. Hueco Mountain Macrofossils and Pack Rat Middens.

Horowitz et al. 1981). Palynological work in the immediate project region includes Dean's (1989) study from the Loop 375 project. She suggests that mesquite pollen first occurs in samples that may date to the Middle and Late Holocene. Mesquite pollen is rare in Early Holocene samples, a conclusion that fits well with the regional pack rat midden data. Dean also notes that grass pollen is more frequent at greater depths in pollen profiles. Horowitz et al. (1981) also suggest more grass during the late Holocene period. These local data fit well with the pollen studies to the north, and the period between about 3000 and 1500 B.P. may well have been one of cooler temperatures and increased effective moisture in the El Paso region.

Stable isotope data are ambiguous with regard to a potential mesic interval. Temperature data suggest a cooler period began just before 2570 B.P. (Monger 1993: 184); however, carbon isotope ratios, which are still dominated by ^{3}C plants, do not reflect it. The consistency of ^{3}C plant dominance in alluvial fans after 4000 B.P. may be, in part, a result of the setting. Today, large expanses of creosote, a ^{3}C plant that moved into the area around 3700 B.P., dominate the fans. Unfortunately, the central basin isotopic sequence does not help resolve this conflict because signatures are not available after 3000 B.P.

The major change in vegetation over the last 1,500 years appears to be a continuation of the shift toward a desert shrub complex that began in the Middle Holocene. Data other than the pack rat material for most of this period is lacking, but several tree-ring sequences are available for the surrounding mountains for a 350-year period (Table 2.1). The Sacramento sequence is the average of three chronologies reported by Drew (1972). The Organ sequence represents a single location also reported by Drew (1972). The sequences have comparable data between A.D. 1600 and 1950, and the variability in the two reflects effective moisture, with values greater

than 100 reflecting cool and/or wet periods (high effective moisture) and those lower than 100 reflecting warm and/or dry periods (low effective moisture).

Table 2.1. Regional Tree-Ring Values.

	Organ Mountains	**Sacramento Mountains**
1600–1750 (High Variability)		
Mean	104.50	99.00
Standard deviation	33.60	29.50
Coefficient of variation	0.32	0.30
Minimum	23.00	10.00
1751–1900 (Low variability)		
Mean	98.30	95.00
Standard deviation	25.20	20.10
Coefficient of variation	0.26	0.21
Minimum	46.00	52.00
1901–1950 (High variability)		
Mean	104.00	103.00
Standard deviation	35.40	30.70
Coefficient of variation	0.34	0.30
Mean	15.00	26.00

Source: Drew (1972). The Sacramento sequence is the average of three chronologies, and the Organ sequence represents a single location.

Although the sequences are fairly consistent, there is considerable variability from year to year, particularly the period from 1901 to 1950. A period of fairly low variability occurred between 1751 and 1900. Before 1751, the degree of variability was comparable to the modern variation. These data, then, suggest that the extreme year-to-year variation in rainfall seen in the modern sequence was not characteristic of the 1750 to 1900 time block, but that the pre-1750 time block had similar fluctuations.

The pre-1900 period corresponds with survey reports and historic accounts that suggest much of the area was stable grassland rather than the present-day, mesquite-dominated desert scrub (York and Dick-Peddie 1969). It was into this stable grassland that large herds of cattle were introduced in the 1880s after the arrival of the railroads and during a period of higher than normal rainfall. However, several droughts occurred in the late nineteenth century, and the entire rainfall pattern seems to have shifted away from the stability evidenced between 1750 and 1900. The herds, in combination with droughts and a return to the highly varied rainfall regime, probably reduced grasslands dramatically and encouraged the spread of woody shrubs, principally mesquite. The combination of cattle and drought may have increased erosion by continuing the destruction of grasslands (but see Neilson 1986 for a somewhat different opinion).

Although mesquite was present in the region prehistorically (Ford 1977)—perhaps as early as 8000 B.P.—most of the mesquite-stabilized dunes that today dominate the central basin are probably of recent origin. Data from the Jornada Experimental Range in southern New Mexico support a rapid, recent spread of mesquite (Buffington and Herbel 1965; Wright 1960). They suggest that in 1858 mesquite occupied less than 5 percent of the range. By 1963 mesquite covered over 45 percent of the range. Nevertheless, several historic accounts (Bartlett 1854; Emory 1857) note that sand dunes were present and may have extended over large areas before the introduction of cattle.

Project Area

A variety of flotation samples from features, pollen samples, and calcium carbonate and soil dates from profiles may have relevance for paleoenvironmental reconstruction in the project area. Figure 2.3 documents a profile of FB7483 (41EP1037) that contains most of the identified soil and sediment units and is the source of three radiocarbon dates and twelve pollen samples. The profile is along a dune near the playa and typical of cases where the *A* horizon is present. The upper date, which was obtained on soil, places the buried *A* horizon at roughly 800 B.P., although the date may be more recent than the actual date range of the soil. Evidence comes from the ^{13}C rations of the soil sample. The carbon isotopic signature (^{13}C, ^{12}C) of the sample is a negative 18.7 mil delta ^{13}C. The $^{13}C/^{12}C$ ratio of mesquite is around -26 mil. Because the sample was collected under the mesquite dune, contamination from organic matter produced by the modern dune is possible. Nevertheless, the date of about 800 B.P. provides a minimum date. The buried *A* horizon, at least in this particular case, is probably older, and based on the underlying feature date, is more recent than 3400 B.P. For some part of this period, then, the climatic regime and vegetational communities supported by that regime were relatively stable and probably somewhat more mesic than at present. These conditions would be conducive to soil development.

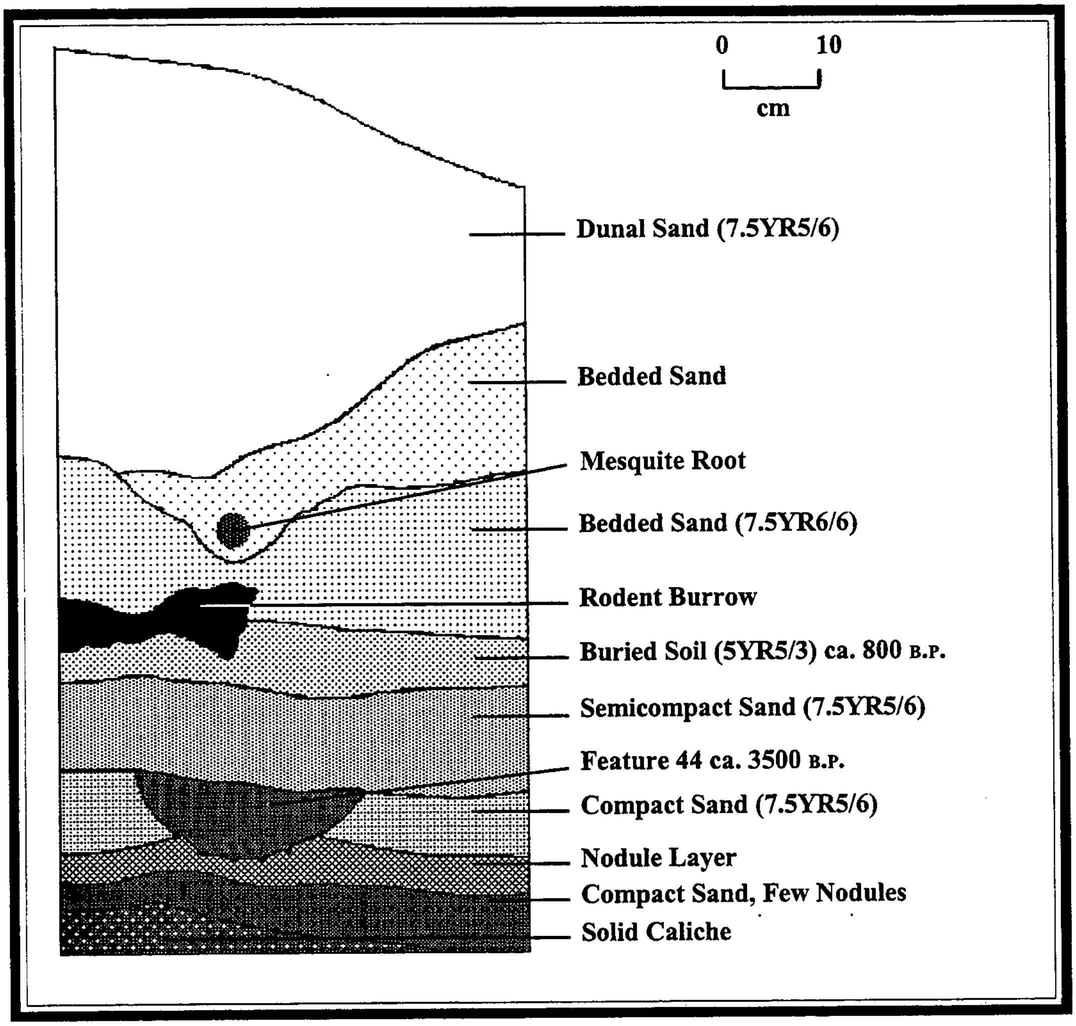

Figure 2.3. Dune Profile, FB7483 (41EP1037).

The bottom date of 16,250 B.P. in the profile comes from a series of calcium carbonate nodules. This date is 7,000 to 9,000 years older than those reported by Monger (1993). Feature 44, which has a radiocarbon date of about 3400 B.P., is dug into this underlying strata of carbonate nodules. The fact that this feature does not appear to be eroded suggests that at roughly 3400 B.P. the underlying caliche layer was within 20 centimeters of the ground surface. Several other dated features in the 3000 to 1300 B.P. range are from sites along the playa ridge. These, too, are often dug into the underlying caliche. Although many are partially eroded and several appear to be relatively intact, most are excavated several centimeters into the underlying caliche. In an uneroded setting this underlying caliche horizon will form between 30 centimeters and 1 meter below the surface (Gile 1975; Gile et al. 1981). Thus, for features to have been dug into the caliche layer, the ground surface must have been relatively close to the caliche. It would appear, then that in many cases the upper sediments were eroded prior to excavation. This provides further support for a major erosional event before 3000 B.P.

Macrobotanical results and the identification of wood specimens used as fuel in features also provide evidence for climatic change. Although mesquite was the major wood source, *populous* was found in two samples and *pinus* in an additional feature (see Chapter 10). The *populous* samples date between about 2600 and 1300 B.P., a period within the suggested mesic interval of 3000 to 1500 B.P.

One final line of evidence relevant to the question of paleoenvironmental reconstruction is the investigation of modern wood conducted for this project. All samples produced dates within the last 150 to 200 years. One interpretation of these data is that a dramatic increase in mesquite occurred over this period, which is consistent with the regional data.

Summary

The modern El Paso climate in general, and the central bolson in particular, is highly varied. Although the growing season is long, productivity of the environment is tied to rainfall concentrated in the late summer months. As is typical in desert settings, the rainfall is unpredictable, both spatially and temporally, and water availability and plant productivity are spotty.

Paleoenvironmental data suggest a major erosional episode before 7000 B.P. that is probably associated with the Altithermal and correlates with increases in desert plants. After much of this time period, in at least some parts of the project area, caliche was often exposed or no more than a few centimeters below the surface. Some evidence indicates a more mesic period, perhaps between about 3000 and 1500 B.P. Minimally, a second major erosional event is probably associated with the introduction of cattle into the region in the late 1800s. Many dunes presently visible in the project area may have formed during this period, although mesquite clearly has been the dominant fuel wood throughout the prehistoric sequence.

Chapter 3

PREHISTORIC OCCUPATION

Several authors provide summaries of the cultural history of the area, including Beckes (1977); Beckes et al. (1977); Camilli (1986); Carmichael (1986); Kauffman (1984); Kelley (1984); LeBlanc and Whalen (1980); Lehmer (1948); Marshal (1973); O'Laughlin (1979, 1980); Seaman et al. (1988); and Skelton et al. (1981).

Paleoindian Period

Paleoindian populations, the earliest known human occupants of the El Paso area, were present from about 9000 to 6000 B.C. They are represented primarily by isolated finds of projectile points and by open sites in the Tularosa Basin (Beckes 1977; Carmichael 1986; Krone 1975) and San Andres Mountains (Eidenbach 1983). Although several sites are known for the region, few are reported in detail.

MacNeish et al. (1993) argue that lithic debris from Pendejo Cave in the Otero Mesa area of Fort Bliss dates before 35,000 B.P. Assessment of this claim, however, must await publication of the details of the excavation, the dates, the stratigraphy, and the materials associated with those dates.

The earliest accepted occupation in the area is associated with Clovis material, which is represented by the recovery of several isolated projectile points. Clovis occupations may be in the region (Beckett 1983; Weber and Agogino 1968), but no well-documented sites are reported.

Isolated Folsom projectile points from throughout the area have been recovered and several Folsom sites are reported in the Fort Bliss maneuver areas (Amick 1991; Carmichael 1986). Wimberly (1973) briefly summarizes the Lone Butte site north of Orogrande, and Beckett (1983) describes several Folsom sites in the Rhodes Canyon area in the San Andres Mountains. Dr. David Carmichael of The University of Texas at El Paso is analyzing Folsom component material from FB1613 in Fillmore Gap between the Franklin and Organ mountains on Fort Bliss. Analysis of this site is incomplete, but tool manufacturing debris dominates the Folsom material (Amick 1991).

The pattern of Paleoindian material in the area suggests that small, mobile groups ranged over large territories. Population density was probably low. Several Paleoindian tools have been recovered in the current project area, but it is unclear whether these represent scavenged items or the remains of a Paleoindian occupation.

Archaic Period

The Archaic period (6000 B.C. to A.D. 200) in the El Paso area is better represented in the record. Reports are available on regional surveys (for example, Carmichael 1986), cave excavations (for example, Cosgrove 1947), and open site excavation (Fields and Girard 1983; O'Laughlin 1980; O'Laughlin and Martin 1989, 1990; O'Laughlin et al. 1988). A broad-spectrum adaptation based on hunting and gathering appears to have been established and there is evidence for sedentism during certain periods of the year (Carmichael 1986; O'Laughlin 1980).

MacNeish (1989) excavated several rock shelters in the area and greatly increased the available data on the Archaic period. He suggests a series of Archaic phase designations based primarily on projectile point types, radiocarbon dates from sites such as Todson Cave, and excavations in Fresnal Shelter. The earliest is the Gardner Springs phase (6000 to 4000 B.C.) followed by the Keystone (4000 to 2500 B.C.), Fresnal (2500 to 900 B.C.), and Hueco (900 B.C. to A.D. 250) phases. In this report, the term *early Archaic* is synonymous with the period represented by Gardner Springs. The *middle Archaic* roughly corresponds to the Keystone phase, and the *late Archaic* includes the Fresnal and Hueco phases.

Anderson (1993) outlines a settlement typology for the Archaic that represents the only available detailed settlement systems study for Archaic remains in the central basin. The sites are primarily small and have particular relevance to the current project. The

settlement typology uses about 160 sites recorded by Carmichael (1986), as well as several other excavations. Anderson's typology classifies components into one of MacNeish's four Archaic phases and defines four kinds of sites: task force, microbands, macrobands, and base camps. Task force sites are locations that usually lack hearths but occasionally have one; they represent a limited set of activities. Microband sites, defined as having one to three hearths, appear to represent family camps. Macroband sites, which have four or more hearths or large amounts of ground stone, represent multiple family camps and appear to be seasonal occupations or represent a coalescence of microbands at certain times of the year. Base camps appear to have structures and were occupied more intensively then macroband sites. They may represent occupations through one or more seasons of a year.

Using this framework, Anderson outlines a series of changes in the number of occupations representing different kinds of sites, their location across the landscape, and the seasonality of occupations. She suggests a reduction in mobility through time and defines more sites, more macrobands, more base camps, and more task force sites in the late Archaic, or Hueco phase, than in earlier periods.

Cultural-historical patterns during the Archaic period suggest that population densities increased and people lived in larger groups. Seasonally occupied sites were established and cultigens were present. Upham et al. (1987) report a corrected direct maize date between 1807 and 1195 B.C. for Tornillo Rockshelter. Tagg (1993) reports similar early dates for Fresnal maize. Carmichael (1981) and Jones (1990) also report other early dates associated with corn, but most researchers suggest a substantial dependence on hunting and gathering during much of this time frame.

During survey, Project 90-11 personnel recovered several projectile points representing occupations throughout the Archaic period. Chronometric results from testing and excavation demonstrate that many features date to the end of the late Archaic. The Archaic period, in fact, is a major time of occupation in the project area when measured by radiocarbon dates.

Formative Period

The Formative period (A.D. 250 to 1450) is divided into two phases, the Mesilla phase (A.D. 250 to 1100), and El Paso phase (A.D. 1100 to 1450). Several researchers (Carmichael 1986; Lehmer 1948; Mauldin 1985, 1993a; Miller 1989, 1993a) recognize a third phase, the Doña Ana phase, between the Mesilla and El Paso phases, though this report does not make that distinction.

Mesilla Phase

The presence of brownware ceramics distinguishes the Mesilla phase (A.D. 250 to 1100). Mimbres Black-on-white wares may have come into the area after A.D. 750 but they generally are not common. Although true pithouses occur in the Mesilla phase (Lehmer 1948), most domestic structures are shallow, basin-shaped styles reminiscent of the earlier Archaic period huts (Hard 1983b).

Sites became larger during the Mesilla phase and many more sites and artifacts have been identified by regional surveys than have their Archaic period counterparts. Several excavations, some of which are in analysis stages, should greatly increase the knowledge of this period (Hard 1986; Whalen 1994).

Using survey data Whalen (1977, 1978, 1980, 1986), proposes a site typology that uses site size and the presence of ceramics, lithics, and ground stone to assign sites to categories. He suggests that artifact variety and site size allow residential sites to be distinguished from camps. Residential sites are larger and have all three artifact categories. Conversely, camps are smaller and lack one of the artifact categories.

Whalen (1977, 1978) recorded Mesilla phase sites in all environmental zones, though he suggests an association between sites and playas in the central basin. Based on the wide distribution, he suggests that subsistence was primarily from hunted and gathered resources, but the diet continued to be supplemented by agriculture. Although Carmichael (1986) employs a different definition for what constitutes a residential site on his survey, his results do not significantly differ from those of Whalen for the Mesilla phase.

Hard (1983a) outlines a detailed settlement and subsistence model in which environmental differences dictate seasonal rounds and activities. He argues that winter and spring residential sites were near mountain alluvial fans, and the central basin was

used in a logistical manner during the summer and fall for short-term residences. Research continues to assess these propositions, but initial analysis of survey and excavation material by Hard (1983a, 1986) do not contradict the model.

Results of various research projects suggest that Mesilla phase populations were larger than those of the preceding Archaic period. Mesilla phase sites are present in all environmental zones (Carmichael 1986; Whalen 1977, 1978) and appear to be oriented toward more sedentary use. A generalized subsistence base with contributions from gathering, agriculture, and hunting is suggested.

The Mesilla phase is well represented within the project area by El Paso Brown rim sherds, Mimbres Black-on-white ceramics, and projectile point styles that may date early in the phase. Many tested or excavated features have radiocarbon dates that fall early in the phase, though they often lack ceramics. The end of the Mesilla phase is not well represented in the radiocarbon dates in the project area, but a number of obsidian hydration dates are available for this time.

El Paso Phase

The development of locally made painted El Paso Polychrome ceramics distinguishes the late Formative period occupation, the El Paso phase (A.D. 1100 to 1450), from the preceding Mesilla phase. Intrusive ceramics also change, with Chupadero Black-on-white replacing Mimbres wares.

Regional survey data suggest that the most intensive prehistoric use of the region occurred during the El Paso phase. The phase is marked by more and larger sites, greater artifact densities, and clustered settlement patterns (Carmichael 1986; Whalen 1977, 1978). Pueblos are found along the Rio Grande and both the western and eastern margins of the Hueco Bolson have large El Paso phase settlements. In the western bolson, Whalen (1977) found that nearly half the El Paso phase villages were along low gradient alluvial fans, with many additional sites near alluvial fans with playas. Whalen (1978) also documents villages associated with alluvial fans on the eastern margin of the Hueco. Carmichael (1986) identifies similar core areas in the northern Hueco Bolson and suggests they were created during the Doña Ana or early El Paso phase.

A settlement and subsistence model for the El Paso phase developed by Mauldin (1986) is based on Hard's (1983a) Mesilla phase work, but assumes a primarily agriculture-based subsistence. He suggests a dichotomy between primary and secondary villages with primary villages located in well-watered areas near mountain slopes. Mauldin (1986) argues that these sites had a fluctuating population throughout the year and a high intensity of use. Secondary villages, both along mountain slopes and in the central basin associated with playas, represent late summer residential occupations with a focus on gathering and hunting.

Excavations of El Paso phase sites suggest a settlement pattern focused along lower alluvial fans or the Rio Grande (Bradfield 1929; Brook 1980; Browning et al. 1992; Gerald 1988; Lehmer 1948; Scarborough 1985). Some pueblo sites in the area may have well over 100 rooms (Brook 1970), though most have less than 10. Several rooms have evidence of special use.

Scarborough's (1984, 1986, 1992) excavation of the Meyer Pithouse Village, which dates to the late thirteenth century, reveals the use of deep, quadrilateral pithouses and formalized trash disposal patterns suggesting a somewhat sedentary system. Corn, cultivated beans, and bottle gourd were present, along with a substantial amount of rabbit bone. Pithouses rather than pueblo architecture characterize other early El Paso phase sites (Kegley 1982; Miller 1989), though they do have El Paso Polychrome and Bichrome ceramics. The change in ceramics, then, is not accompanied by a shift to pueblo architecture. This shift may not have taken place until after 1250 A.D. (Brook 1980).

El Paso phase occupation in the project area is not well represented. Although clusters of El Paso Bichrome and El Paso Polychrome appear on sites, they are discrete occurrences, and Project 90-11 efforts revealed no intrusive ceramics that could be placed in the El Paso phase. Several late Formative projectile points were collected, and three radiocarbon dates from a possible structure and two additional features fall within the phase. A significant number of obsidian hydration dates also fall in this time frame.

Protohistoric Period

The Protohistoric occupation of the region is perhaps the least understood time period for the area. It represents the bridge between regional abandonment of the pueblo villages and the beginning of the sixteenth-century Spanish Entradas into this part of the Desert Southwest. Spanish explorers observed the indigenous Manso and Suma fishing and hunting along the Rio Grande. Farming also was inferred because these inhabitants reportedly had agricultural products such as corn at their settlements (Bentley 1992).

Within the Project 90-11 boundary, obsidian hydration dates, one at 1468 A.D. and one at 1543 A.D. on two sites, FB6741 (41EP1028) and FB7520 (41EP970), infer Protohistoric evidence. No features or distinctive artifacts were found from this time period, and the two dates may indicate limited occupation of the area.

Spanish Colonial and Euroamerican Period

Project 90-11 personnel documented evidence for occupation of the project area during early historic times on two sites. At FB12072 a burned caliche feature under a mesquite-stabilized dune produced a radiocarbon sample with a midpoint of 1702 A.D. FB12324 had what are probably Spanish Colonial period brownware ceramics, which may range from the seventeenth to nineteenth century.

Beginning in the latter part of the nineteenth century, Euroamericans began to ranch in the Hueco Bolson. The introduction of the windmill in 1881 expanded the carrying capacity of the land by allowing cattle to graze in areas where water previously was not available (Freeman 1977). With the introduction of the railroads into the El Paso region in 1881, cattle ranching increased dramatically. A few isolated finds of artifacts from the late nineteenth and early twentieth centuries were recovered within the project area.

Today, the study area is located in Fort Bliss Maneuver Area 1, which was acquired between 1941 and 1949. The land was private before 1941 and military field exercises were conducted in the study area through maneuver permits. Military remains dating from the 1910s to the present are found throughout the project area. Brass cartridge casings, iron shrapnel, and other debris are scattered across several sites. Appendix A discusses artifacts that date before 1941.

Summary

The cultural history of the Tularosa Basin suggests a gradual increase in population and a reduction in mobility between the Paleoindian and Formative periods. Sites increased in number and size, with an apparent subsistence shift from a focus on hunting and gathering to one in which agriculture played an important role. More permanent occupations occurred later in the sequence, but it is unclear if a sedentary, year-round settlement system ever developed. The Protohistoric, Spanish Colonial, and Euroamerican occupations found throughout the basin are not well documented in the project area.

Chapter 4

SURVEY

Project 90-11 personnel recorded 176 sites during survey of the 6-square-kilometer area. This chapter discusses survey procedures used to define the sites, the temporal assignment of sites, and the distribution of sites. The results of different survey procedures prove that changes in survey intensity significantly alter the quantity of information obtained, including a dramatic change in site size. In addition, this chapter considers the influence of geomorphic factors (erosion and deposition) on site discovery rates and demonstrates a strong relationship between levels of exposure and artifact recovery rates.

Project Area Selection

Two factors governed selection of the project area. First, the area needed to contain, based on previous surveys, numerous small sites for study. Second, the area needed to contain an environmental diversity to maximize the potential of having different temporal, functional, and adaptive patterns represented. Because the central basin desert floor is somewhat homogeneous, a playa association was the primary environmental criterion used in selecting a survey area.

The initial survey area comprised 5 square kilometers in the central basin. This survey area, next to a large, northwest trending playa, contained small sites identified during the Maneuver Area 1 survey (Whalen 1978). It also had the advantage of being near previous studies of small sites. A study of small camps (Whalen 1980) immediately south of the current project area provided an excellent comparative data set. Parts of the Loop 375 testing project (O'Laughlin and Martin 1989; O'Laughlin et al. 1988) are west and south of the project area, and a project (Kauffman and Batcho 1988) that contained several small sites is along a power line to the south and west.

Surveys revealed a considerably higher site density than anticipated based on Maneuver Area 1 survey data (Whalen 1978). This was especially evident on the edge of the large playa that cuts through the survey area. Consequently, an additional 1-square-kilometer area immediately north of the original project area was added. The northern area was surveyed and contained a more manageable data set.

The 6-square-kilometer project area was divided into three subareas (Figure 4.1) determined primarily by the survey method used in each area. The northern area (1 square kilometer) was surveyed at a transect spacing of 5 meters between crews. In the central and southern survey areas, a two-stage survey effectively yielded data at both 16- and 33-meter spacings. Surface collection, testing, and excavation were limited to the northern and southern survey areas; no work other than survey was conducted in the central area because of lack of time and funding. As a result of the surface collection efforts in the northern and southern areas, site boundaries were further adjusted. The various levels of investigation provided a variety of data sets to investigate the influence of transect spacing on the observation of archaeological remains.

Procedures and Results

The Maneuver Area 1 survey (Whalen 1978) recorded 66 sites and several isolated artifacts in the 6 square kilometers of Project 90-11. Given the wide transect spacing of that survey (about 46 meters) and the elapsed time since the initial observations in this active environment, a resurvey of the study area was initiated. The results dramatically changed the initial picture of prehistoric settlement in the area, adding to both the number and size of sites.

A two-stage resurvey design was employed for the central and southern survey areas. The first stage

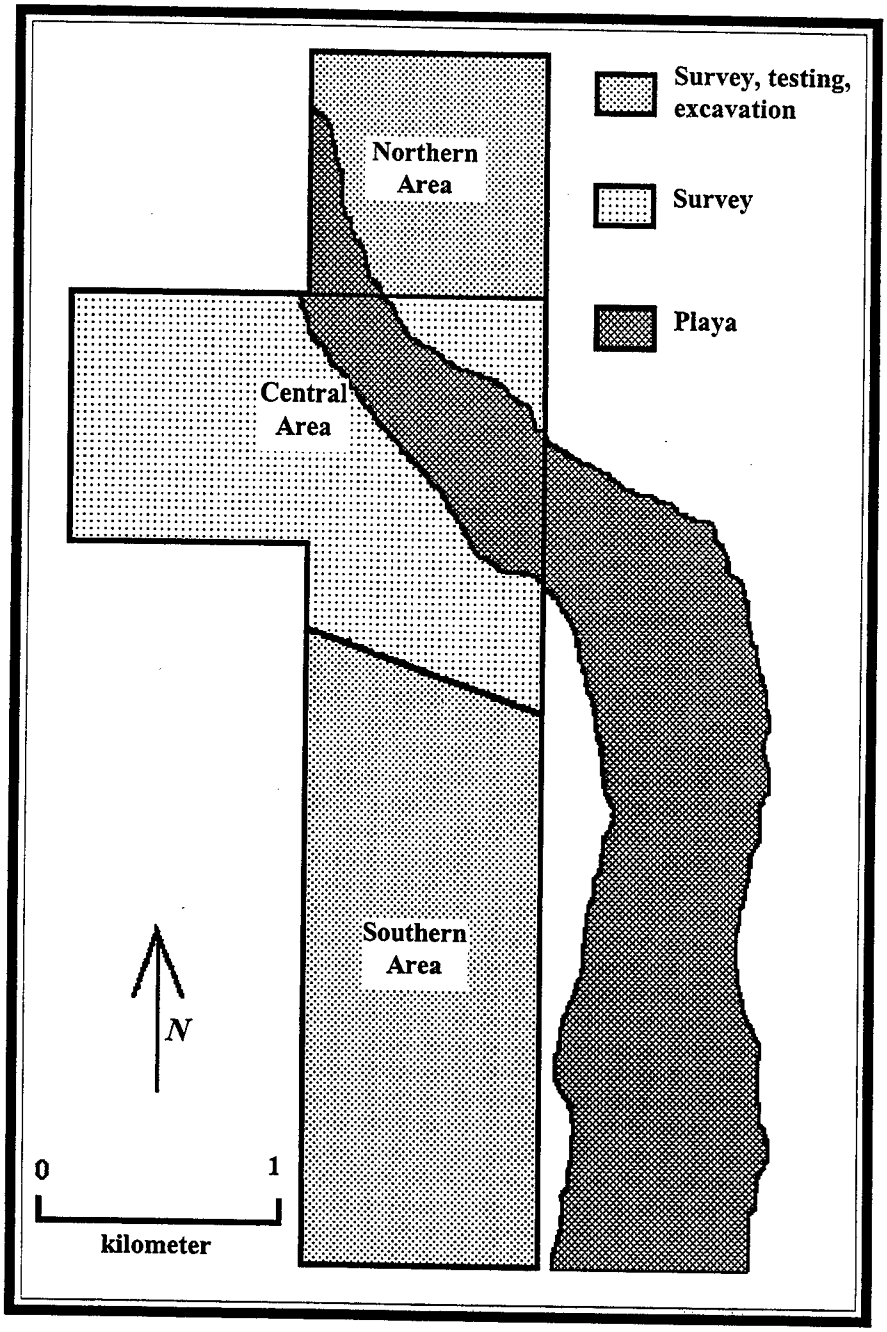

Figure 4.1. Project 90-11 Study Area.

used a transect spacing of 33 meters between crew members. The second stage also used a 33-meter spacing, but was offset 16 meters from the initial survey. This procedure effectively generated three databases—two for 33-meter surveys and, combining the two, one for 16-meter survey. Finally, during surface collection of sites in the southern survey area, the 16-meter data was refined further. This surface collection data is referred to as 1-meter spacing. The various surveys produced several data sets for the southern survey area. With the addition of information from the Maneuver Area 1 survey (Whalen 1978), four survey intensities were available for comparison in the southern area of the project.

The 176 sites recorded in the 6-square-kilometer area are divided into two data sets. The first set contains 87 sites in the central survey area where no work beyond survey was conducted. The second data set, containing 89 sites, is from the northern and southern survey areas. These sites were subsequently surface collected and form the data set from which areas were selected for testing and excavation.

Several site boundaries were arbitrarily defined for ease of management and recording. In most cases, the standard Fort Bliss site definitions were employed. However, an essentially continuous distribution of artifacts along the eastern edge of the southern survey area was broken into smaller sites as recording a site several kilometers in length would have been cumbersome. For comparative purposes within the 6-square-kilometer project area, total site area per grid quad (1 square kilometer) or per survey area was used rather than the number of sites or average site size.

Temporal Placement

Sites were assigned to a temporal period based on specific categories of diagnostic artifacts, primarily ceramics and projectile points. Those with El Paso Polychrome or intrusive ceramics were assigned to the El Paso phase. Sites with El Paso Brown or Mimbres Black-on-white ceramics were assigned to the Mesilla phase, and those with undifferentiated brownware ceramics and no other pottery were assigned to the Formative period.

Several sites were assigned to a time frame based on overviews of projectile point styles by Carmichael (1986), Gossett (1985), and Jones (1990). Currently no agreed upon point typology exists for the area. Figures 4.2 and 4.3 illustrate projectile points from Project 90-11 that could be assigned to temporal periods, with the suggested temporal placement. Projectile point types are sometimes associated with a particular phase, though they often span several. Also, scavenging of earlier tool forms by later occupations may account for the presence of some implements on some sites.

Finally, if no temporally diagnostic artifacts were observed on a site, it was placed in the "unknown" category. This assignment accounted for over 75 percent of the 176 sites. Furthermore, many cultural occurrences within the temporally assigned sites remain unknown because of the low recovery rate of diagnostic artifacts and the limited spatial distribution. For example, Site FB7510 (41EP978) had projectile points, some isolated undifferentiated brownware body sherds, and a single cluster of El Paso Polychrome ceramics. The site classification is multiple component with evidence of occupation before the Formative period and in the El Paso phase. The site is over 10 hectares in size and diagnostic specimens are limited to small areas within the site. The vast majority of material remains on the site are not spatially associated with diagnostic artifacts.

Over 82 percent of the 87 sites recorded in the central survey area lacked diagnostic artifacts (Figure 4.4). The single Archaic assignment is based on a projectile point. Although the point could be assigned to the Archaic period, a more detailed temporal assignment was not possible.

Like the central area, most of the southern and northern survey sites (72 percent) lacked diagnostic artifacts. In contrast to the central area, however, the southern and northern surveys produced sites dating from the Paleoindian period through the El Paso phase. The multiple component category, which contains nine sites, has evidence of Paleoindian artifacts on two sites, early Archaic projectile points on two, and middle Archaic projectile points on three.

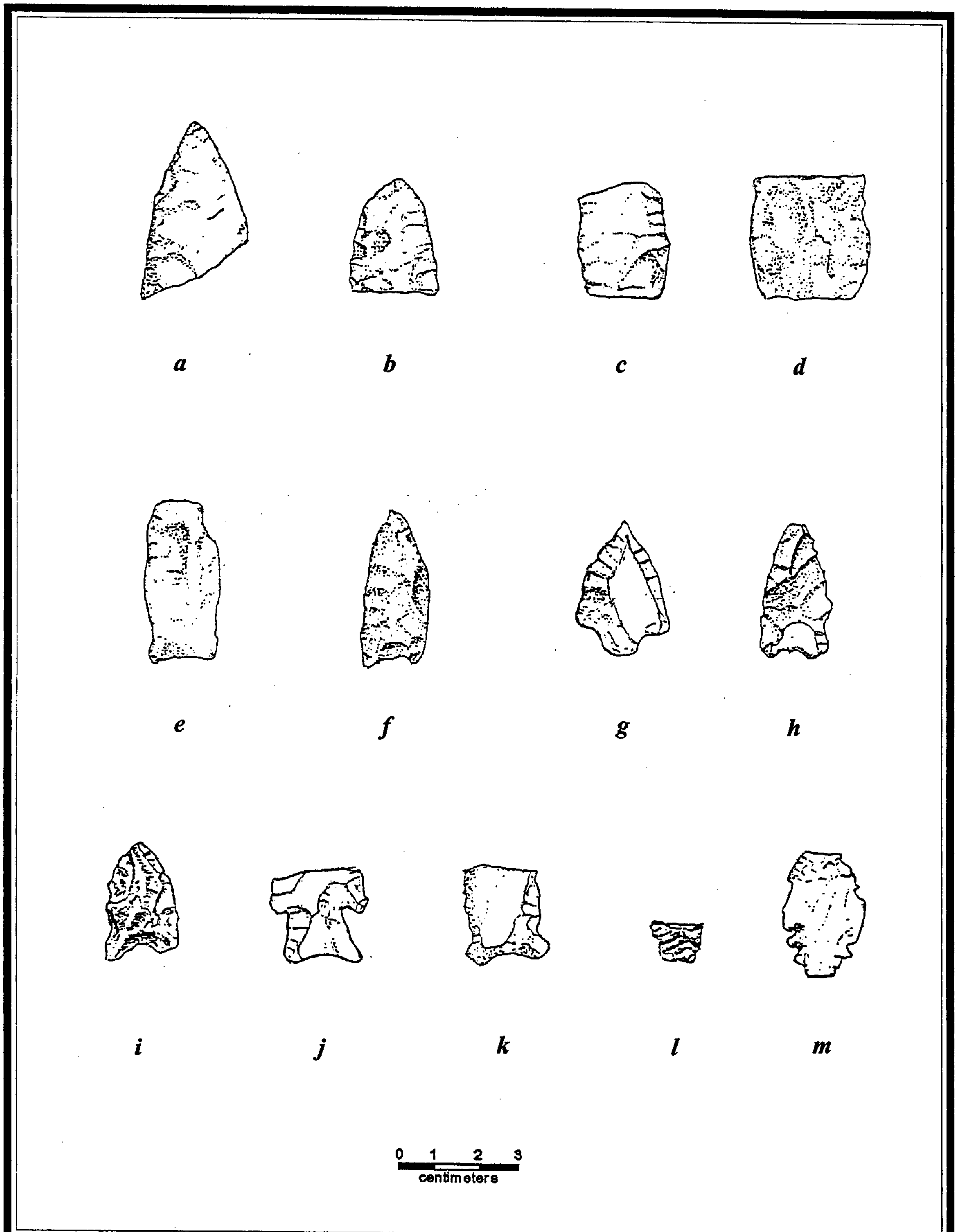

Figure 4.2. Projectile Points from Project 90-11. *a–d,* possible late Paleoindian and early Archaic period; *e–k,* possible early and middle Archaic period.

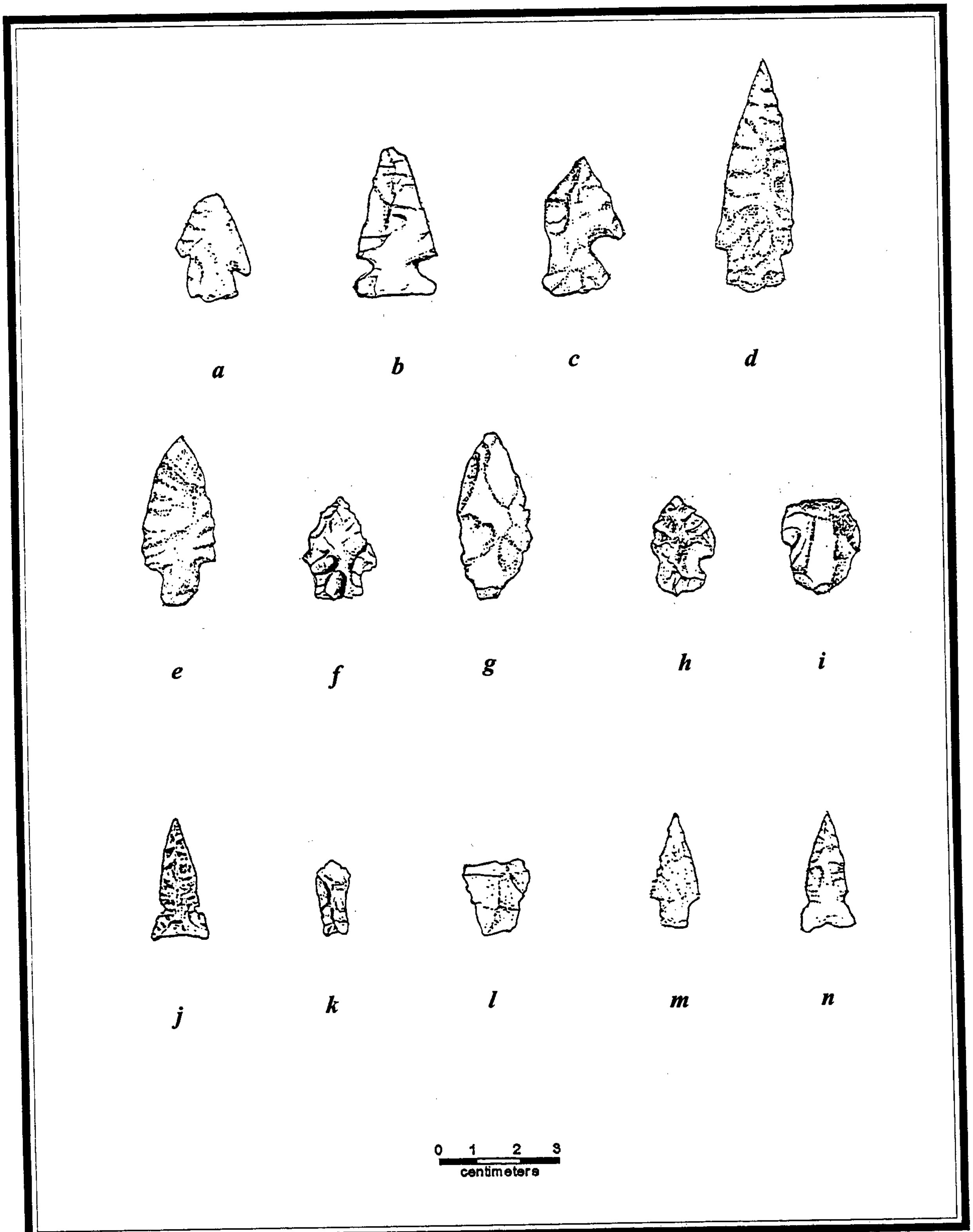

Figure 4.3. Projectile Points from Project 90-11. *a–i,* possible late Archaic and early Formative period; *j–n,* possible late Formative period.

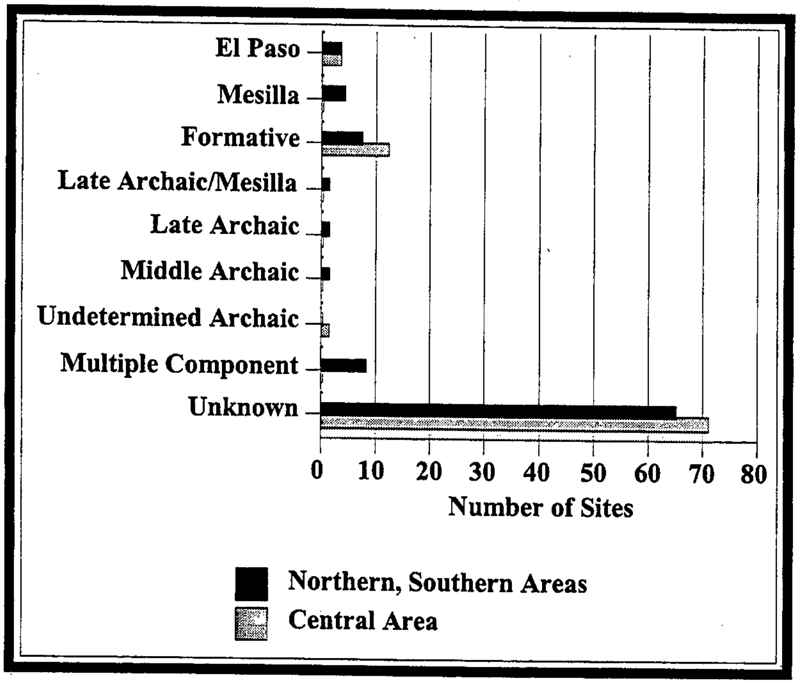

Figure 4.4. Temporal Placement of Sites Based on Diagnostic Artifacts.

Occupation Intensity

Differences in site definition and survey intensity make direct use of site numbers or average site size as measures of occupation intensity unwise. However, it is possible to compare the total site area and the total number of features within the central and southern survey areas. The comparisons suggest that those sections of the project area on the ridge associated with the large playa have the highest intensity of recorded occupation.

In the central survey area, the easternmost quad has the largest number of features (Figure 4.5) and the largest total site area. However, most of the eastern quad in the playa lacks sites, and because only 53 percent of the southern quad is in the central survey area the densities of both features and sites are roughly comparable. The area covered by sites, as well as feature and site density, are greatest in the southern quad when corrected for survey unit size (Figure 4.6). The increased density is primarily on the southwestern side of the playa. This association of high densities of occupations adjacent to the playa also is present in the southern survey area (Appendix B).

The southern survey area contains 60 sites. About 32 percent of the area is within site boundaries, for an average site area of 32.6 hectares per kilometer (Figure 4.7). Although sites are located throughout the southern survey section, there is an almost continuous distribution of material along the eastern edge. This distribution is on a small ridge line adjacent to the large playa, a situation that also is present in the central survey area.

In contrast to the southern and central surveys, the 29 sites in the north covered only 0.051 square kilometers (Figure 4.8). The different densities suggest different intensities of use in the northern area compared to the rest of the project, a difference that may be related to the playa ridge location. Although the southern part of the northern survey section is adjacent to the playa, there is no associated ridge line; rather, the northern area slopes gradually from southwest to northeast.

The association of high densities of archaeological remains with ridge locations in the central basin was also noted on the Loop 375 project (O'Laughlin and Martin 1989). Reasons for this association, however, are not known. The pattern in the current project is partially a result of a greater level of geomorphic exposure associated with the ridge location. However, densities of artifacts and features, as well as results of testing and excavation, seem to indicate the ridge area also had a greater level of use throughout the occupation of the project area.

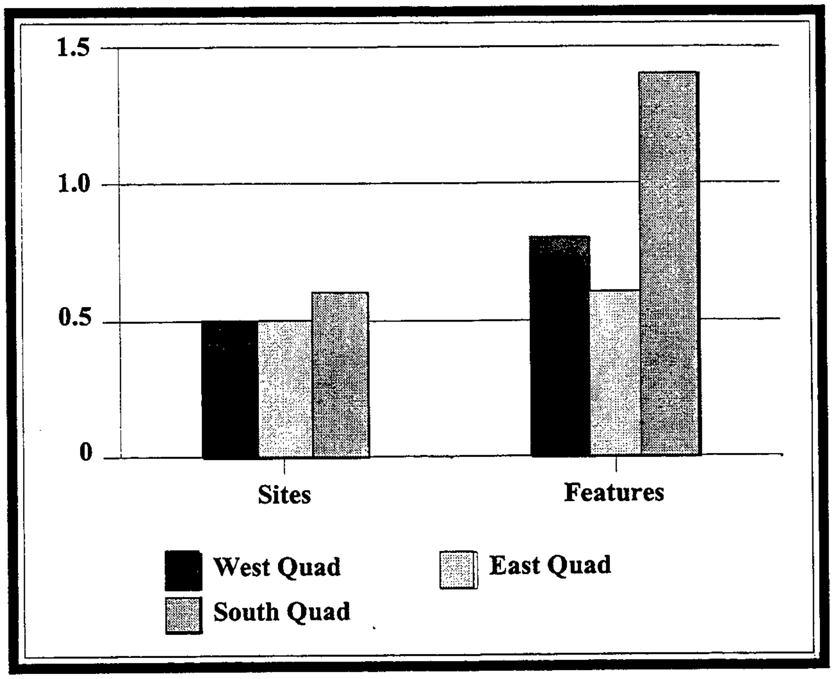

Figure 4.5. Sites and Features per Hectare, Central Survey Area.

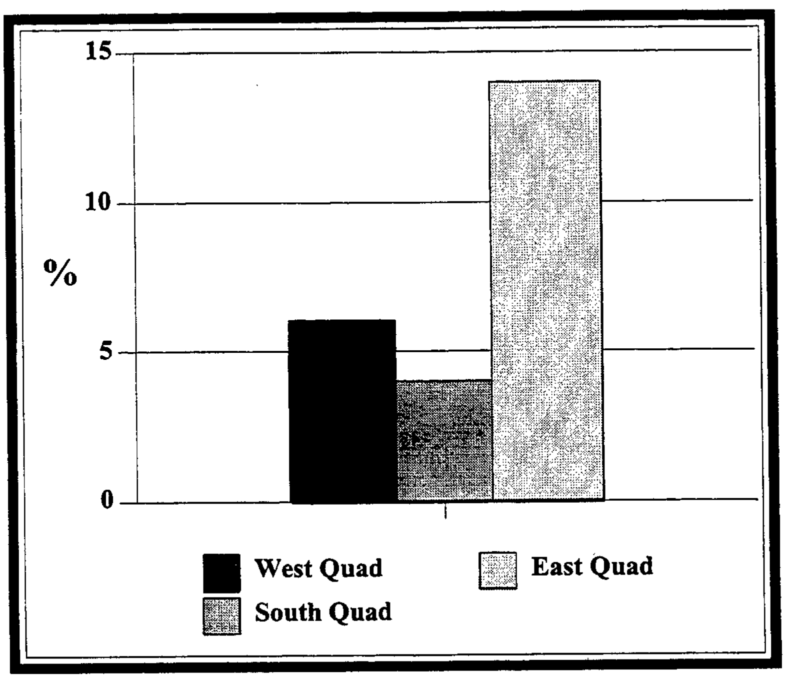

Figure 4.6. Area Contained within Site Boundaries, Central Survey Area.

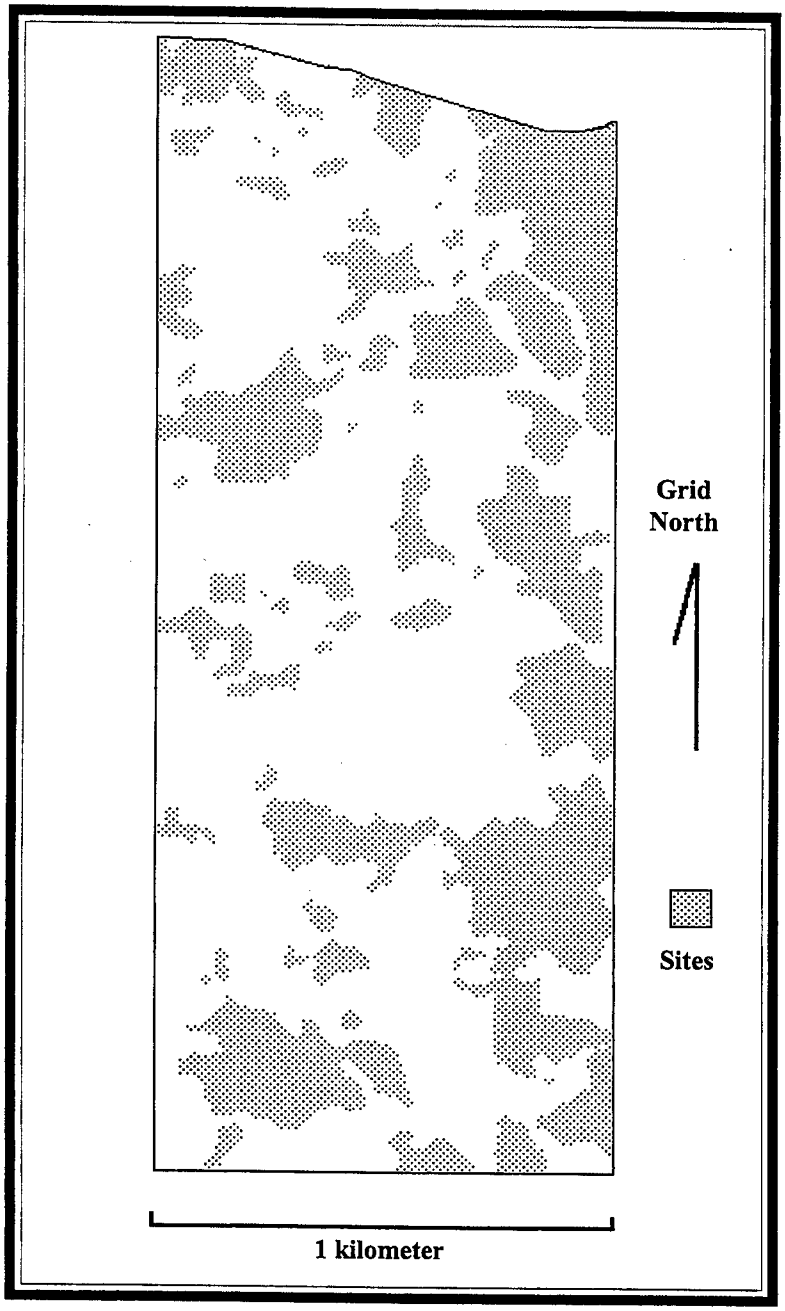

Figure 4.7. Site Distribution, Southern Survey Area.

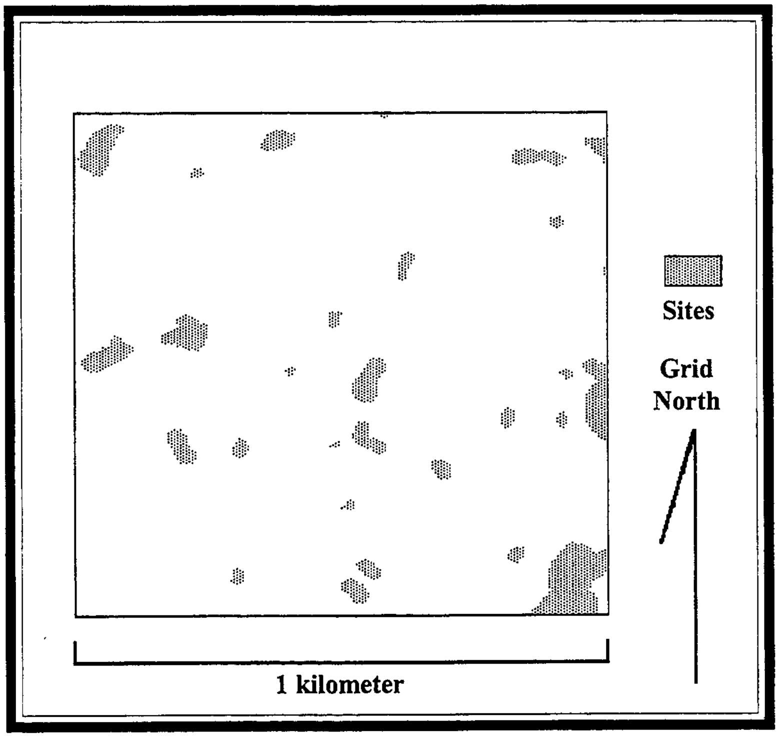

Figure 4.8. Site Distribution, Northern Survey Area.

Survey Intensity and Data Recovery

Multiple data sets for the southern survey area, each generated by a different survey intensity, provide dramatic results when compared. Different survey intensities altered the number of sites recorded, the average size of the sites, the total amount of site area, and the distribution of sites. At low survey intensity (wide transect spacing), sites were small. As survey intensity increased, sites increased dramatically in size. Previously isolated small sites were joined as closely spaced transects resulted in the recording of items not seen with wider transects (Figure 4.9). A rough correspondence between site boundaries was discerned in several cases, whereas other areas lacked any relationship. Changes in site boundaries among the various surveys are thought to be the result of differing amounts of time spent on recording.

Comparing four survey intensities in the southern survey area revealed dramatic increases in recovery rates (Figure 4.10). At the extremes of the survey data, the differences are staggering. The total number of sites recorded by Whalen in his 1978 survey was 63. This compares to 60 sites recorded in the most intensive effort of this project, surface collection or 1-meter spacing. However, the average site size jumped from 27 square meters to over 132 square meters, an increase of almost 500 percent. A similar increase in the numbers of recorded features occurred, as well, from 113 in the 1978 data to over 800 in the most intensive survey. Obviously, survey intensity is a critical element in determining the quantity and quality of data recovered.

Most of the survey data on Fort Bliss was generated using transect spacings of 46 meters (Maneuver Areas 1 and 2) or 33 meters (Maneuver Areas 3 through 8). The results of changing survey intensities demonstrate that actual densities and numbers of sites recorded on previous surveys are dramatically underrepresented. The problem is especially acute for small sites, which make up the vast majority of occupations on Fort Bliss.

The results also underscore the arbitrary nature of sites as they are commonly defined. As noted, the site definitions employed on this project were those of the Cultural Resources Branch, Directorate of Environment, at Fort Bliss. They were consistently

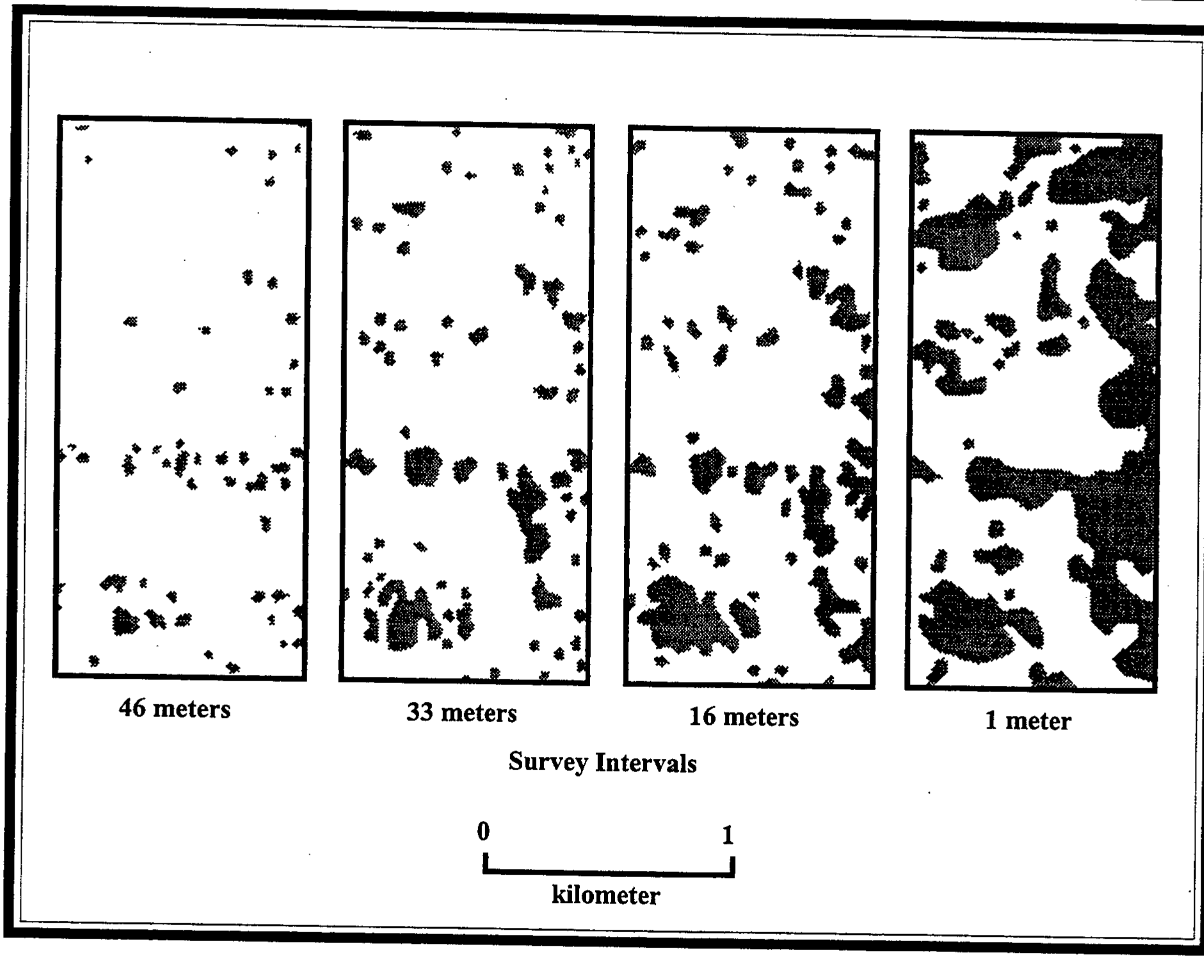

Figure 4.9. Survey Intensity Results.

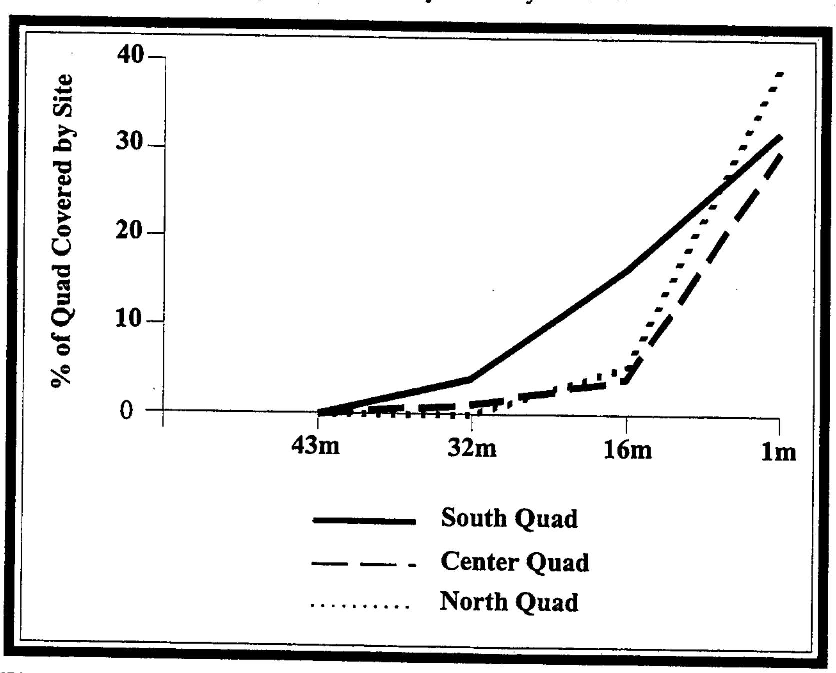

Figure 4.10. Survey Intensity and Recovery Patterns, Southern Area. The 1-meter spacing represents the final site area defined after surface collection.

applied on all surveys, except the division of the continuous material distribution along the playa ridge in the final survey and surface collection effort. Yet, because of the changes in intensity, the boundaries and contents of sites produced by the different surveys are dramatically different. Increasing survey intensity expanded site boundaries and the number of artifacts present on a site. Treating site assemblages as analytical units and asking questions about them or assigning entire sites to temporal periods based on small numbers of diagnostic artifacts may not be the most appropriate ways to proceed given the diverse results of survey intensity.

Exposure and Site Area

Like survey intensity, geomorphic elements can have a significant impact on the archaeological record. Erosion can combine previously disassociated artifacts, thereby increasing site size, artifact density, and artifact variety. Conversely, deposition of sediments over archaeological surfaces can reduce the visibility of archaeological remains. These processes are especially important in an area like the central basin on Fort Bliss, where deflation and deposition are common.

To assess the impact of exposure on recovery rates and as a guide to planning testing and mitigation efforts, project personnel systematically mapped the extent of exposure or deposition throughout both the northern and southern survey areas (Figures 4.11, 4.12). The presence of exposed calcium carbonate nodules, exposed Stage 3 or 4 caliche, or a frequent occurrence of Organ 1 soil (Monger 1993) defined exposed surfaces, which are primarily eroded locations. Deposition areas often contained recent eolian sands or stabilized sand dunes. Many areas were between the two extremes, but attempts were made to use the division consistently.

Much of the northern survey area is exposed, whereas exposure in the southern survey area is primarily associated with the playa ridge location. A series of built-up sand deposits covers much of the southern area away from the playa and dots the ridge.

Comparison of exposure with site distribution suggests a relationship between the two (Figure 4.13). Archaeological remains often are recovered in exposed areas, which account for about 58 percent of the southern survey area. Yet these sections contain

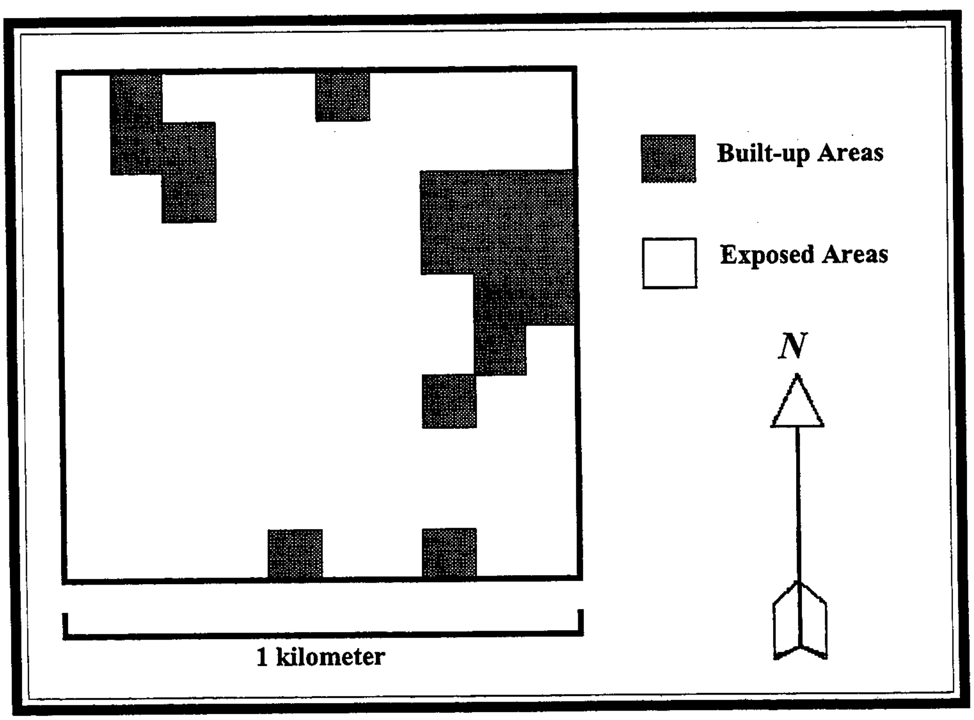

Figure 4.11. Exposure Patterns, Northern Survey Area. Patterns were mapped in 100-by-100-meter blocks.

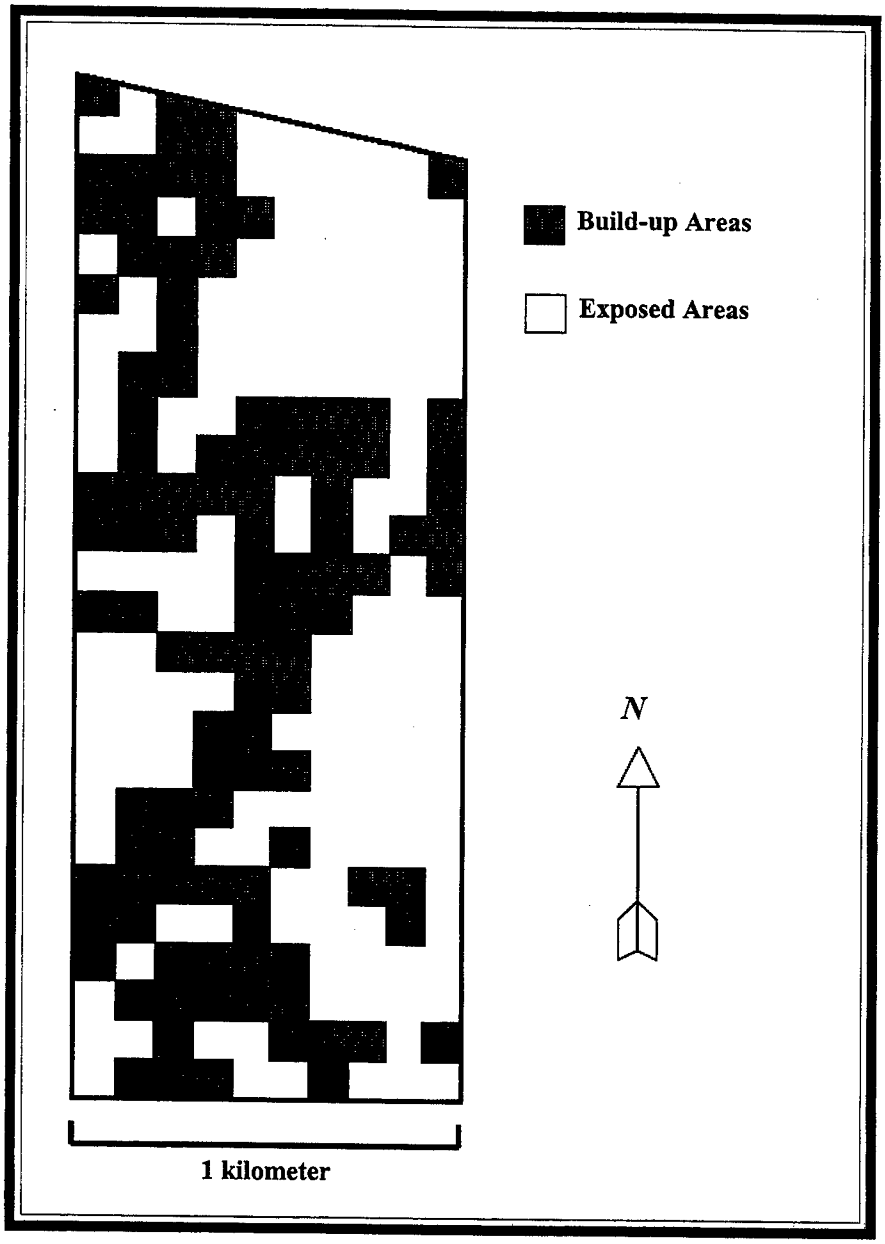

Figure 4.12. Exposure Patterns, Southern Survey Area. Patterns were mapped in 100-by-100-meter blocks.

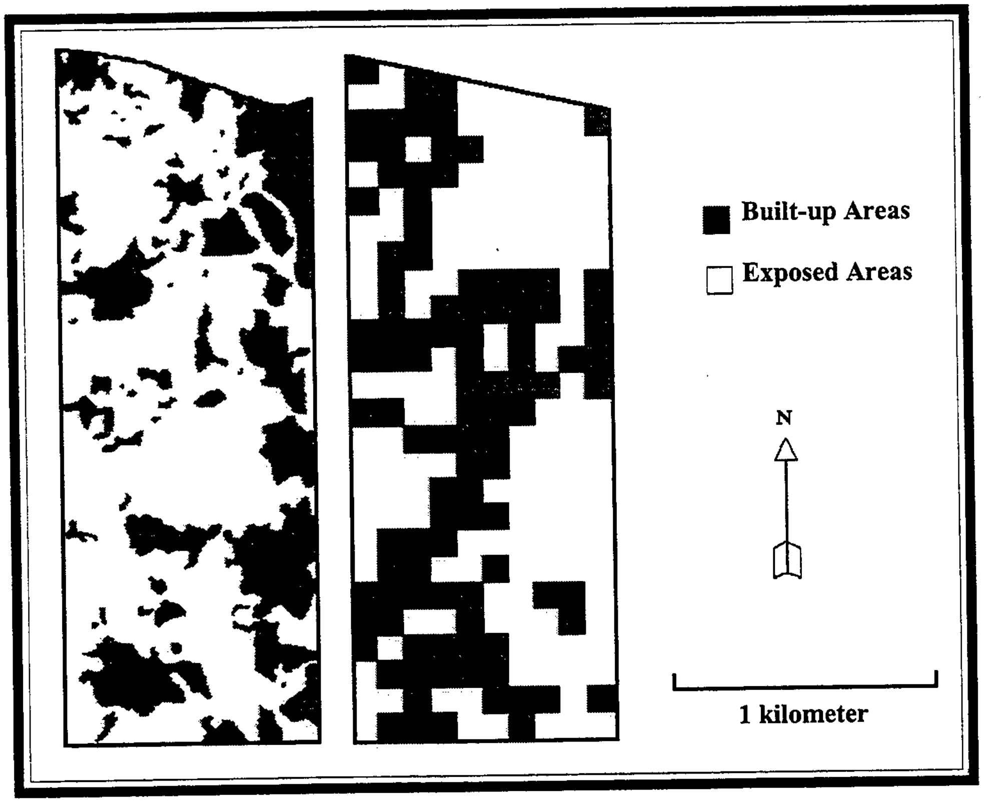

Figure 4.13. Relationship between Sites and Exposure, Southern Survey Area.

72 percent of the site area. Conversely, built-up areas account for 42 percent of the southern survey but contain only 28 percent of the site area. In the northern survey region, 87 percent of the project area is exposed and 13 percent contains built-up sands. The exposed area contains 96 percent of the total site area. In many cases, areas of built-up sands that resulted from erosion and deposition separate site boundaries.

Thus, the amount of site area in a given section of the project has a strong relationship to the amount of exposure. This is not surprising; it underscores the arbitrary nature of site boundaries. The boundaries, and the artifact and/or feature material in the site defined by those boundaries are, to an unknown degree, the result of geomorphic processes.

Summary

Few of the 176 sites recorded in the 6-square-kilometer project area could be placed in any temporal category based on the recovery of diagnostic artifacts. Intensity of occupation, as measured by site size, is highest along the eastern edge of the southern survey section, suggesting some association with the low ridge and playa.

A comparison of survey intensity in a part of the project areas shows that increasing survey intensity has a dramatic influence on parameters such as site size and the number of features. Exposure also has an impact on the recording of archaeological material. These results underscore the arbitrary nature of sites, both in terms of identified boundaries and the artifact and feature assemblages encompassed by those boundaries.

Chapter 5

SURFACE COLLECTION

This chapter summarizes the methods used during surface collection of the combined southern and northern survey areas; no work beyond survey was conducted in the central area of the project. Surface collection on 89 sites resulted in the recovery of 6,725 items, most of which were in the southern project area, and the recording of detailed information on 790 of the 883 surface features.

Patterns in artifact and feature data at the project level were related to degrees of erosion and deposition. Exposed or eroded areas at a site level have a higher surface artifact density than those that are built up. Features with stains are more common in exposed settings than in built-up areas and exposed features have more associated artifacts. Patterns between exposure and artifact and feature observations at the intrasite level are also apparent.

Intrasite distributions of artifacts suggest a series of discrete surface artifact clusters. Often, many such clusters are within one site, suggesting that the larger sites identified by survey and surface collection may be the result of repeated occupations. This observation is consistent with chronometric information for several sites that have radiocarbon dates spanning several millennia. Nevertheless, several cases of spatially associated features appear to date to about the same time. A cluster analysis routine identified 282 spatially discrete artifact clusters that formed units for analysis of surface material on the 89 sites. These areas may have a higher probability of representing temporally and, possibly, functionally associated artifacts. Artifact clusters also result from patterns of erosion and deposition, but geomorphic associations of artifacts and features cannot, at present, be separated from clusters that are more directly the result of related behavior.

Procedures

Surface collection involved returning to areas identified as sites based on the results of the 16-meter transect surveys of the southern area and the 5-meter transects in the northern area. Boundaries were changed as more detailed observations during surface collection were made. Because of the general low density of artifacts, a strategy of recording artifact provenience was thought to be the most effective way to record all artifacts. The precise locations of more than 6,700 lithics, ceramics, and ground stone were recorded. Isolated fire-cracked rock was not collected but was recorded on 1:1,500-scale enlargements of 1:3,000-scale aerial photos commonly used to record site information on Fort Bliss.

Vegetation, severity of exposure, and presence of high or built-up sands or eroded areas were recorded in site and nonsite contexts. Observations on categories and contents of features seen during surface collection also were made. These data were used to design testing and mitigation strategies for selected sites in the southern and northern study areas (Mauldin and Graves 1991).

Site boundaries and feature locations were mapped on 1:1,500-scale aerial photo enlargements. Locations of major grid stakes were plotted and used to fine-tune the scale of the photos. Sketches of sites showing major dunes, feature locations, isolated pieces of burned rock, and site boundaries were prepared from the enlarged maps.

In addition to the site assemblage information, 129 artifacts not associated with a site were plotted on 1:3,000-scale aerial photos and collected.

Artifact Recovery and Project-Level Patterns

Of the 89 sites identified within the 3.5 square kilometers of the southern and northern survey areas, 79 had lithics, ceramics, or ground stone on the surface, and eleven of those consisted of artifacts only, with no features. The remaining ten had features, often composed of burned rock, but lacked any other artifact category. In several instances the project boundaries cut through site boundaries, and

collections of artifacts and detailed observations on features were limited to the part of the site within the project boundaries.

At a project level, lithic materials dominated the surface collections, with unutilized flakes and debitage making up almost 49 percent of the 6,725 items recorded on sites (Table 5.1). Ground stone accounts for 21.5 percent of the assemblage, and most of it is fragmentary and fire-cracked from use in features. Ceramics make up just more than 10 percent of the assemblage, occurring on only 29 percent of the sites, with 37 percent of the total from two sites. Formal tools make up 3.8 percent of the assemblage, and utilized flakes account for 8.4 percent. Cores comprise 4.5 percent of the assemblage.

Table 5.1. Artifact Totals Surface Collection.

FB Number	Site Area Sq. m	Feature	Ceramic	Core	Debitage	Flake	Ground Stone	Hammerstone	Retouched[1]	Tested Core	Utilized Item	Total[2]
6741 (41EP1028)	82,212	138	145	31	47	922	275	47	50	16	147	1,680
7252 (41EP1832)	139	1	0	0	0	0	0	0	0	0	0	0
7483 (41EP1037)	17,100	32	0	15	5	41	28	5	12	4	18	128
7484 (41EP1034)	34,817	33	24	18	6	109	34	5	9	8	34	247
7505 (41EP985)	4,735	10	5	0	0	9	12	1	0	0	2	29
7508 (41EP982)	40,502	28	0	6	1	30	20	3	6	1	10	77
7510 (41EP978)	106,401	72	39	33	7	320	115	18	43	17	70	662
7517 (41EP972)	43,047	48	20	8	3	65	80	11	4	5	6	202
7520 (41EP970)	57,551	70	58	16	16	164	133	17	15	9	35	463
7547 (41EP964)	86,976	151	48	12	11	179	182	22	20	6	34	514
7569 (41EP962)	9,587	11	0	0	2	30	6	1	1	0	7	47
7580 (41EP1753)	23,070	26	0	6	1	45	85	8	7	1	10	163
7583 (41EP1750)	17,786	6	0	4	1	17	3	1	2	2	4	34
10407	2,285	0	0	0	0	5	0	1	1	0	2	9
10408	560	1	0	0	1	2	1	0	0	0	0	4
10409	817	1	0	0	1	0	3	0	0	0	1	5
10410	9,196	3	0	1	1	23	5	1	4	0	3	38
10411	11,921	16	108	2	2	14	20	1	2	0	2	151
10412	516	1	5	0	0	0	0	0	0	0	1	6
10413	243	1	0	0	0	1	8	0	0	0	0	9
10414	717	1	0	0	0	0	0	0	0	0	1	1
10415	2,162	0	0	2	0	1	0	0	2	0	0	5
10416	285	2	0	0	0	8	1	0	1	0	1	11
10417	1,967	4	22	1	0	11	3	3	0	0	2	42

[1] *Retouched category includes both facially and marginally retouched specimens.*
[2] *Totals reflect only those areas of sites that fall within the project area*

(Continued on next page.)

Table 5.1. Artifact Totals Surface Collection (continued).

FB Number	Site Area Sq. m	Fea-ture	Cera-mic	Core	Debitage	Flake	Ground Stone	Hammer-stone	Retouched[1]	Tested Core	Utilized Item	Total[2]
10418	210	0	0	0	0	0	1	0	1	0	0	2
10419	1,289	0	0	0	0	0	0	0	1	0	0	1
10420	1,080	1	0	0	0	2	0	0	0	1	0	3
11298	678	1	0	1	0	2	8	0	1	0	1	13
11299	5,509	9	5	0	1	15	8	4	1	0	1	35
12017	403	1	0	0	0	4	0	1	0	0	0	5
12069	25,742	14	0	5	1	96	29	3	4	0	18	156
12072	22,876	14	1	1	1	24	17	2	1	1	7	55
12090	204	0	0	0	0	1	0	0	0	0	2	3
12091 (41EP4906)	570	1	0	0	0	10	0	0	0	0	0	10
12092	280	0	0	0	0	0	0	0	1	0	1	2
12093	430	1	0	1	0	0	0	0	0	0	0	1
12095 (41EP4907)	114	1	0	0	0	0	0	0	0	0	0	0
12096	2,081	3	0	0	0	6	0	0	1	0	3	10
12097	2,781	3	0	1	0	1	0	0	0	0	1	3
12100	10,862	10	29	2	0	26	11	0	4	1	8	81
12102 (41EP4908)	9,445	9	8	3	2	28	28	0	1	1	5	76
12213	700	1	0	0	0	1	1	0	0	0	1	3
12214	666	0	0	0	0	12	1	0	3	0	1	17
12216 (41EP4911)	773	3	0	0	0	2	1	0	0	0	0	3
12217	1,240	3	0	0	1	5	6	0	0	1	1	14
12218	7,043	5	0	2	0	24	4	3	1	0	0	34
12219	2,230	3	18	0	1	1	30	0	0	0	2	52
12220	2,344	0	0	1	0	1	1	0	0	0	1	4
12221 (41EP4912)	11,262	12	0	1	1	16	48	0	4	0	6	76
12222	3,754	1	10	0	1	8	1	2	3	0	0	25
12223	1,963	2	0	0	1	7	1	0	0	0	1	10
12224 (41EP4913)	3,694	4	0	0	0	5	8	0	0	0	2	15
12225 (41EP4914)	146	1	0	0	0	0	1	0	0	0	0	1
12226	512	1	0	0	0	0	0	0	2	0	0	2
12227	56	1	0	0	0	0	0	0	0	0	0	0
12228	163	1	0	0	1	1	0	0	0	0	0	2
12229	59,422	23	13	16	16	518	73	9	21	10	66	742
12230	389	1	0	0	0	1	0	1	0	0	2	4
12231	1,249	0	1	0	2	44	3	1	1	0	3	55
12233 (41EP4915)	6,460	6	0	0	0	4	3	0	2	0	0	9

(Continued on next page.)

Table 5.1. Artifact Totals Surface Collection (continued).

FB Number	Site Area Sq. m	Feature	Ceramic	Core	Debitage	Flake	Ground Stone	Hammerstone	Retouched[1]	Tested Core	Utilized Item	Total[2]
12234	768	2	0	0	0	3	1	0	0	0	0	4
12235 (41EP4916)	675	5	0	0	0	0	0	0	0	0	0	0
12237	549	0	0	0	0	12	1	0	0	0	0	13
12239	1,655	10	0	2	5	57	44	6	4	5	11	134
12240	1,225	3	0	0	1	9	0	0	0	1	1	12
12241	3,075	4	0	1	0	13	0	0	3	0	0	17
12243	12,020	16	16	1	1	7	12	1	4	0	3	45
12245	12,382	3	0	5	2	48	9	0	2	0	7	73
12246	1	1	0	0	0	0	0	0	0	0	0	0
12247	30,884	12	18	2	1	43	34	2	7	3	11	121
12248	937	2	42	0	0	4	0	0	0	0	0	46
12249	1,666	2	0	2	1	8	2	0	1	0	0	14
12252	3,344	2	1	0	1	1	5	0	0	0	1	9
12253	48	1	0	0	0	0	0	0	0	0	0	0
12254	1,766	0	0	0	0	12	5	0	2	0	2	21
12255	13	1	0	0	0	0	0	0	0	0	0	0
12256	309	1	0	0	0	0	1	0	0	0	0	1
12316	3,696	6	0	0	2	20	8	2	1	0	1	34
12317	1	1	0	0	0	0	0	0	0	0	0	0
12318	3,715	1	0	2	0	8	2	1	0	0	0	13
12319	950	1	0	0	0	1	1	0	0	0	1	3
12320	4,462	1	1	0	0	7	7	1	0	0	1	17
12321	1,383	4	0	0	0	1	0	0	0	0	0	1
12324	560	2	29	0	0	0	0	0	0	0	0	29
12326	11	1	0	0	0	0	0	0	0	0	0	0
12327	2130	1	0	0	0	4	2	0	0	0	2	8
12329	1083	2	3	0	0	0	0	0	0	0	1	4
12330	4647	5	22	2	3	13	12	0	2	0	1	55
12331	188	1	0	0	0	0	0	0	0	0	0	0
Total	837,355	883	691	206	151	3,132	1,444	184	258	93	566	6,725

Artifact recovery on sites at the project level is related to the degree of site exposure. Comparing the average surface density on 32 sites that are predominately in built-up areas with the 57 sites in exposed areas shows a higher recovery rate for the latter. The 32 sites in built-up settings have an average surface density of 0.008 artifacts per square meter (median of 0.005), whereas the 57 exposed sites have an average of 0.01 and a median of 0.006. Although this difference is not extreme, all sites with artifact densities above 0.04 are in exposed areas. Totals were derived by contrasting the average surface artifact density with exposure levels.

When all artifacts from sites in exposed areas are compared with all artifacts in built-up areas the built-up areas have a higher average surface density (0.012 artifacts per square meter) than the exposed areas (0.007 artifacts per square meter). Treating exposure as a class, sites in built-up areas have

roughly twice as many artifacts per square meter, which is contrary to the expectation that exposure would increase the overall number of artifacts. Exposure, when treated as a class, crosscuts differences in site densities. Thus, exposure by itself does not seem to determine artifact densities; however, it does influence recovery rates at a given site. This contradiction probably relates to the scale at which erosion or exposure was mapped.

The relationship between site location and major land form also influences artifact densities. Both the largest site area and the highest number of features are along the playa ridge. The average density is highest away from the playa ridge, with the southern region averaging 0.0098 artifacts per square meter of site area, the northern survey region averaging 0.0097, and the playa ridge averaging 0.0076. These densities are contrary to the survey data, which suggests heavier use along the playa ridge. The medians, however, support the survey data observations, with the playa ridge having a median artifact density of 0.007. The remaining areas of the southern survey area have a median of 0.0055, and the north a median of 0.004. Higher average surface artifact densities are influenced by relatively small site sizes, which result in higher surface artifact densities. The median, then, may be a better reflection of the intensity of use, and these values support the survey observations.

Features

Seventy-eight of the 89 sites in the project area contained features; except for the large stain category, most features were hearths. The features included:

- Burned caliche without stain
- Burned caliche with stain
- Fire-cracked rock
- Fire-cracked rock with stain
- Burned caliche and fire-cracked rock with stain
- Burned caliche and fire-cracked rock without stain
- Stain smaller than 1 meter
- Stain larger than 1 meter

Detailed information was recorded on 790 of the 833 features. The remaining 43 were tested early in the project before the initiation of this recording procedure (Table 5.2). Recorded information included estimates of the number of rock in four size classes (less than 0.5 inches, 0.5 to 1 inch, 1 to 2 inches, and greater than 2 inches), estimates on the number and categories of artifacts with the feature, and the condition of the feature.

Burned caliche was present in 80 percent of all features, and those with only burned caliche accounted for 45 percent of the 790 features. Fire-cracked rock features that did not contain burned caliche made up only 3 percent. Given the availability of caliche in the project area compared with other rock types, this was expected. Many fire-cracked rocks are artifacts with ground surfaces, and much of the remainder is made up of rock types commonly used for ground stone but without a ground surface. These probably represent pieces of metates and manos reused as hearth rock.

Table 5.2. Types of Features with Detailed Data.

Feature	#	%
Burned caliche	322	40.76
Burned caliche, fire-cracked rock	254	32.15
Stain, small	133	16.84
Burned caliche, stain	33	4.18
Burned caliche, fire-cracked rock, stain	23	2.91
Fire-cracked rock	22	2.78
Fire-cracked rock, stain	2	0.25
Stain, large	1	0.13
Total	790	100.00

Contrasting the kinds of features with the two exposure categories suggests a relationship between surface stains and the amount of exposure. Of the 586 features in the exposed areas, 26.5 percent were stains compared with only 15.2 percent of the 204 features in the built-up areas, which suggests that they are more likely to be visible in exposed settings.

Features in exposed areas also have a greater average number of artifacts with an average of 2.03 artifacts per feature. In built-up settings, an overall average was 1.32 artifacts per feature. Thus, exposure is likely to reveal more artifacts around features. In both eroded and built-up areas, the median number of artifacts is zero; the vast majority of features lacked associated artifacts, regardless of exposure.

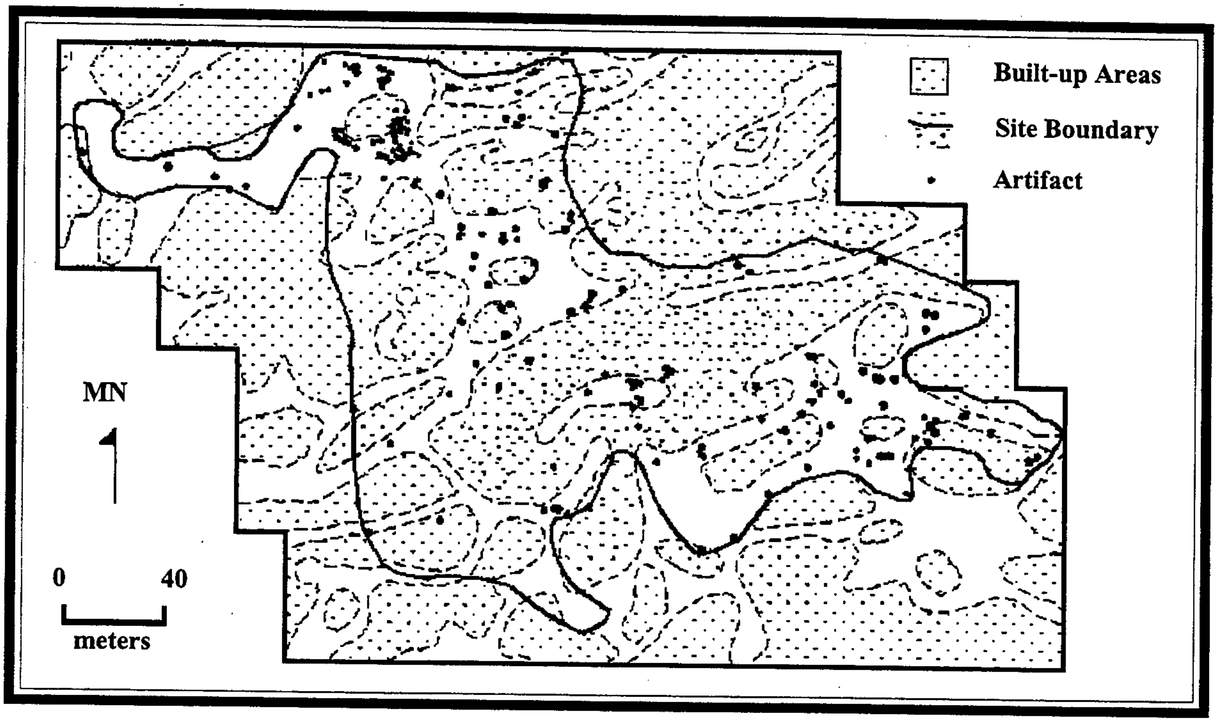

Figure 5.1. Artifact Distribution Relative to Exposure at FB7484 (41EP1034).

Intrasite Artifact Patterns

Patterns in artifact densities and feature characteristics correspond to both exposure and location and appear to result from geomorphic and behavioral processes. On a site-by-site basis, artifact distribution suggests that erosion and deflation, as well as behavior, interact in complicated ways. The distribution of artifacts within sites suggests that large sites are composed of small clusters. These clusters are, in some cases, the result of erosion and exposure rather than a reflection of associated prehistoric behavior. There is also a strong relationship between exposure and the recovery of artifacts at FB7484 (41EP1034). Exposed surfaces account for 49 percent of the site area, or roughly 16,650 square meters and 51 percent (17,350 square meters) is built up (Figure 5.1). The 49 percent of the site that is exposed contained 205 of the 247 artifacts (83 percent), an overall density of 0.0123 artifacts per square meter. This contrasts with a density of 0.0024 artifacts per square meter in built-up areas. Twenty-seven (87 percent) of the 33 surface features were within the 49 percent of the site classified as exposed. Many built-up areas that contained artifacts were near the margins of the exposed areas, suggesting that they were in the process of deflating, or the deposits were shallower, exposing some artifacts.

The relationship between exposure and artifact recovery suggests that some associations between artifacts and features may be the result of unrelated occupations being collapsed onto a single surface, but the frequency of this phenomenon is not known. In many cases, surface artifact clusters were probably the result of unrelated activities being exposed by erosion. In others, they may represent discrete activities conducted within a larger single site or repeated occupations occurring in the same general area. The 89 sites defined by the survey and surface collection data may be composed of numerous, temporally discrete occupations. These sites may contain a series of smaller units associated in space but not necessarily time, a premise supported by radiocarbon dates.

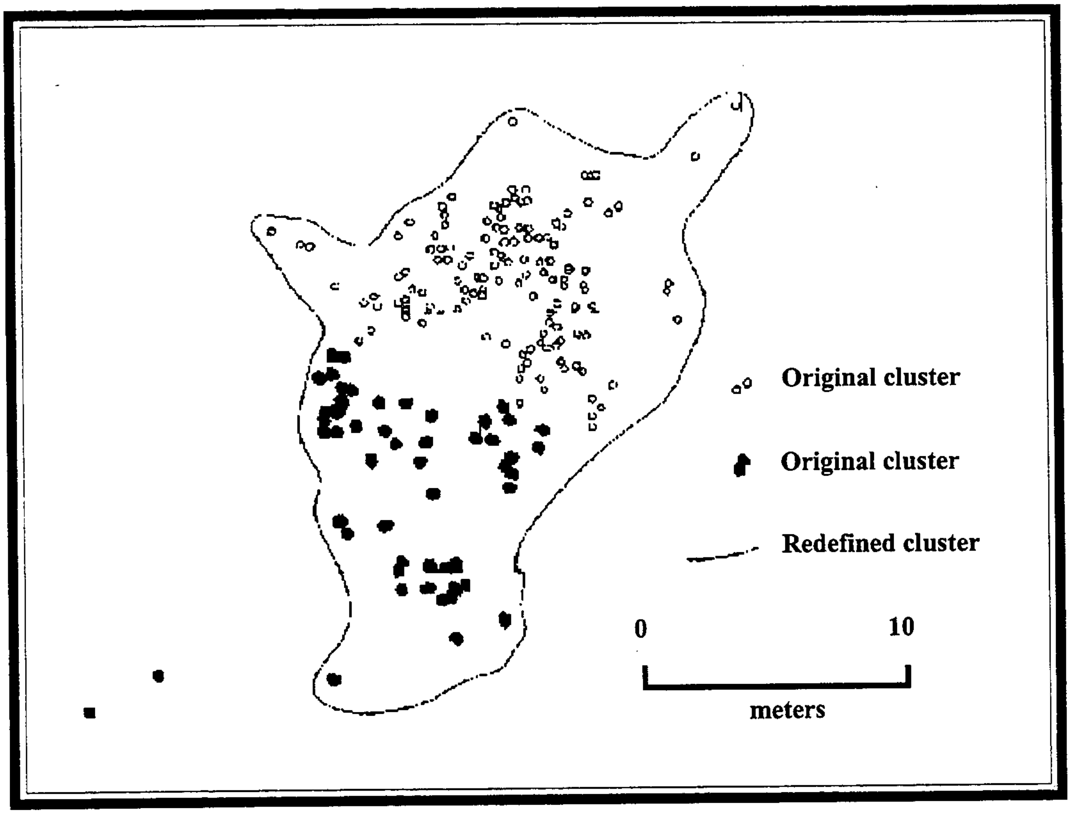

Figure 5.2. Original and Combined Clusters on Site FB6741 (41EP1028). Two distribution clusters defined by the cluster program were subsequently redefined into a single cluster.

Artifact Cluster Definitions

Assuming that sites are composed of smaller units—an assumption supported by the spatial distribution of artifacts and radiocarbon dates on features—attempts were made to identify artifact clusters that might have behavioral or adaptive significance within sites. A Euclidean distance cluster analysis on artifacts within sites was run as a preliminary method for identifying clusters. The clustering procedure involved a version of the FASTCLUS program in SAS (SAS 1987), which uses a k-means method to identify disjointed clusters. Analysis included all artifacts except fire-cracked rock; in addition, all ground stones that had secondary uses as fire-cracked rocks were eliminated from the site level assemblages. Features were not included in cluster definitions because the principal concern was identifying artifact relationships.

The potential number of clusters on a site was initially identified as a function of site size. Most isolated sites in the project area were less than 1,000 square meters and, as the goal was to identify small occupations within large sites, the number of potential clusters was determined by dividing the total site area by 1,000 square meters. For example, Site FB7483 (41EP1037), a 1.71-hectare site, could have a maximum of 18 clusters. The program identified eight clusters on this site. Clusters with less than four artifacts were deleted from the analysis because of the small sample size.

After clusters were produced, each was plotted on the appropriate site map and each cluster solution was examined. The goal was to maximize the number of artifacts in clusters and minimize those that were not assigned to a cluster. Consequently, the program could split a tight distribution into two groups if more items could be incorporated into the overall solution by this splitting. Analytically, splitting was not desirable because material groups were divided into different clusters.

An extreme example of splitting can be seen on FB6741 (41EP1028), Cluster 22 (Figure 5.2). The

cluster program split the continuous occupation in this area into two groups allowing several outlying artifacts to be included and maximizing the number of artifacts in the cluster. However, splitting this continuous distribution into two analytical units did not make sense. When this was observed, the cluster solution was changed to reflect more accurately the actual distribution by deleting one cluster group and placing its members in the remaining cluster. For the data in Figure 5.2 the original two-cluster solution was condensed to a single cluster and the solution was based on the cluster program. In a few cases the solutions were "massaged" to reflect actual, on the ground, artifact distributions. The average area of the 282 clusters is just more than 133 square meters (median of 91.5). Clusters average 14.8 artifacts (median of 7), and 1.19 features (median of 1).

All cluster solutions were printed on maps, and boundaries were drawn around the artifacts within clusters and any associated features. The 282 surface clusters, rather than the 89 sites, formed the basis of some functional and adaptive analyses. Spatial analysis of artifacts, spatial and temporal patterns identified through radiocarbon dates on features, and obsidian hydration dates indicate that these clusters have a higher probability of reflecting discrete occupations, though in several cases they may be amalgamations of material from unrelated occupations.

Clusters represent an attempt to reduce large sites to smaller units that may have a higher probability of reflecting material that is functionally and temporally related. In effect, smaller envelopes of data are created for analyses. However, this reduction in envelope size does not solve the problem of developing an understanding of the processes responsible for stuffing the envelope. The smaller clusters —just like the larger sites that contain them—may be the result of a variety of processes. Like sites, they may be affected by erosion, or they may be the result of a variety of differently organized behaviors. The advantage of working at the smaller scale is that at least some components responsible for creating the clusters may be operating at this smaller scale.

Table 5.3 provides a summary of cluster attributes on the 48 sites in which clusters were identified. Several larger sites, such as FB6741 (41EP1028), FB7510 (41EP978), FB7547 (41EP-964), and FB12229, have numerous clusters, suggesting that larger sites contain a series of smaller, discrete, groups of artifacts and features.

Table 5.3. Cluster Patterns within Sites.

Site	Cluster Frequency	Mean Area Sq. meters	Average No. of Features	Average No. of Artifacts
FB6741 (41EP1028)	63	201.40	1.57	21.30
FB7483 (41EP1037)	8	149.10	2.38	9.60
FB7484 (41EP1034)	14	98.10	1.14	10.60
FB7505 (41EP985)	2	54.50	0.00	5.00
FB7508 (41EP982)	4	74.80	0.50	4.80
FB7510 (41EP978)	31	105.70	0.52	13.36
FB7517 (41EP972)	8	117.40	1.25	9.63
FB7520 (41EP970)	18	157.80	1.72	15.00
FB7547 (41EP964)	19	164.00	3.74	12.58
FB7569 (41EP962)	2	86.00	1.50	12.50
FB7580 (41EP1753)	8	77.40	0.87	6.38
FB7583 (41EP1750)	1	145.00	0.00	6.00
FB10407	1	30.00	0.00	5.00
FB10410	1	154.00	0.00	15.00
FB10411	5	101.00	1.40	22.40
FB10412	1	24.00	0.00	5.00

(Continued on next page.)

Table 5.3. Cluster Patterns within Sites.

Site	Cluster Frequency	Mean Area Sq. meters	Average No. of Features	Average No. of Artifacts
FB10416	1	183.00	0.00	8.00
FB10417	3	54.30	1.00	11.00
FB11299	2	72.00	1.00	10.50
FB12069	6	153.50	0.50	17.00
FB12072	2	49.50	0.50	4.00
FB12091 (41EP4906)	1	74.00	0.00	8.00
FB12096	1	48.00	1.00	6.00
FB12100	4	38.00	0.50	8.50
FB12102 (41EP4908)	4	101.00	1.25	8.75
FB12214	1	68.00	0.00	12.00
FB12217	1	202.00	3.00	6.00
FB12218	3	146.70	1.00	7.70
FB12219	1	28.00	1.00	18.00
FB12221 (41EP4912)	2	109.00	1.00	5.00
FB12222	2	81.00	0.00	9.50
FB12223	1	58.00	0.00	5.00
FB12229	22	152.40	0.18	27.10
FB12231	2	148.50	0.00	25.50
FB12237	2	34.50	0.00	6.00
FB12239	10	87.10	0.60	7.10
FB12240	1	195.00	3.00	12.00
FB12241	1	22.00	0.00	8.00
FB12243	3	76.30	2.67	8.33
FB12245	4	132.80	0.25	10.75
FB12247	5	60.00	0.20	8.40
FB12248	2	61.50	0.00	22.00
FB12249	1	49.00	1.00	7.00
FB12254	1	77.00	0.00	11.00
FB12316	2	85.00	1.00	8.50
FB12318	1	86.00	0.00	5.00
FB12324	1	10.00	0.00	29.00
FB12330	3	32.00	0.68	12.67

SUMMARY

Surface collection of the 3.5-square-kilometer area in the southern and northern survey areas of the project recovered 6,725 items from 89 sites. Surface features totaled 883, and detailed information was recorded on 790. Patterns in both artifact and feature data at the project level were related to levels of erosion.

Intrasite distributions suggest a series of discrete artifact clusters. Identification of these clusters depends on exposure; however, the degree to which the cluster attributes depend on erosion is not clear. If erosion caused material from unrelated occupations to collapse onto the same surface, the interpretation of cluster attributes in terms of discrete temporal, functional, or adaptive process is problematic. Given the environmental data discussed in Chapter 2, the survey and surface collection data discussed in Chapters 3 and 4, and the data presented in this chapter, erosion probably has a significant impact on cluster composition. Occasionally, however, erosion may have exposed material from discrete occupations, rather than collapsed material from unrelated occupations. Identification of these cases, and their isolation from clusters that are essentially palimpsests, is not possible given the current knowledge of these processes. Nevertheless, the site level is probably inappropriate as an analytical unit for these kinds of sites. The appropriateness of the cluster level remains open to question, as do the processes responsible for their formation. Lowering the scale from sites to clusters seems to be a more appropriate level from which to begin. However, the problem of understanding the processes involved in creating these clusters is not solved.

Chapter 6

TESTING AND EXCAVATION

Project 90-11 personnel hand excavated 4,124 1-meter squares on 64 sites in the southern and northern sections of the project and 31 1-meter squares outside site boundaries. Additional work included 30 backhoe trenches cut in these areas, 91 auger holes placed on sites, and 308 features tested. A total of 2,968 ceramics, lithics, and ground stone specimens was recovered from subsurface testing. The majority of artifact types in the excavated material were flakes and debitage.

Differences between surface and subsurface assemblages suggest that specimen sizes may be critical attributes in the assemblages. Patterns of subsurface artifact density are, unexpectedly, not related to general classes of exposure, with the highest subsurface artifact densities occurring along the playa ridge, an area that is primarily exposed. This area also has the highest intensity of occupation as indicated by survey and surface collection data.

Stains and stains with fire-cracked rock dominated the 308 features excavated on the project. This was primarily a result of the selection criteria because the focus was on features that had a high probability of providing radiocarbon dates. Most of the features with remaining pits were circular in outline and basin shaped in cross section. Exposure affected feature measurements, with those in exposed classes being significantly larger, probably as a result of the smearing of boundary edges making delineation more difficult. Exposure did not, however, have a significant impact on depth; eroded features were only slightly shallower than features in built-up areas. This was consistent with the suggestion that most of the study area had, at some point, been subjected to various levels of erosion.

Two of the 308 excavated features were pit structures with internal pits and clearly defined boundaries. Several other large stains that may represent structures were tested or excavated but the evidence was not conclusive.

Comparison of surface and subsurface artifact sizes at the project level suggests that subsurface sizes are significantly smaller. This fact, coupled with the limited number of extensive tests in surface-defined clusters, makes direct comparison between surface clusters and excavated material difficult.

Sixty-six excavation blocks that had both some level of exposure and a moderate number of artifacts formed the primary analytical units for comparing excavated assemblages. These units contained most of the subsurface items on the project. Nineteen of the 66 blocks have radiocarbon dates.

Procedures

Project 90-11 used four principal excavation and testing strategies. Auger tests on eight sites and backhoe trenches on several other sites supplemented these strategies. Procedures developed to collect artifact and feature information efficiently from generally eroded deposits maximized spatial coverage, while maintaining horizontal control at a 1-by-1-meter level. Vertical provenience often consisted of a single level because deposits were generally eroded and multiple occupations separated by sterile deposits had an extremely low probability of occurring in the project area. The exception to this was in structure excavations, feature excavations where internal stratigraphy was visible, and in several cases were natural levels were obvious. Following Fort Bliss procedures, all deposits were screened through one-eighth-inch mesh.

The first strategy involved the excavation of 49 1-by-1-meter units in the southernmost grid quad in the project. The purpose of these units, which were the first excavated by the project, was to provide information on the general soil profiles in the area, as well as data on the potential for buried surface deposits. They were systematically placed by dividing the kilometer into 49 squares of similar size and placing a 1-by-1-meter test unit in the center of each. Nineteen test units fell within site boundaries Of the 30 units that fell outside site boundaries, one contained artifacts. Data could be interpreted as supporting site boundaries as an accurate reflection of de-

posits in the project area, but this interpretation would be unjustified. Given the extremely low level of off-site testing combined with the low density of artifacts in the project area, the recovery of any material in the 30 off-site test units is surprising.

A second strategy involved placement of 70 1-by-1-meter units on FB6741 (41EP1028) to gain information on subsurface deposits and soils at the site. These units were excavated in arbitrary 10-centimeter levels with the exception of the initial level, which varied in depth as surface elevations within each unit varied. Depths were controlled by reference to the datum. The final level was terminated if a subsurface feature or caliche was encountered.

The third procedure involved strategic placement of 1-by-1-meter units on a few sites to test for subsurface material in built-up sand or dune areas, or to investigate concentrations of artifacts recovered from the surface. They also were used to investigate vertical depth of various soils within a site.

The initial strategies were developed before the completion of surface collection. However, as surface collection and observation of features progressed, the total number of features in the study area increased to more than 800, and aspects of the early testing strategies were modified. Emphasis was placed on features that had a greater probability of yielding sufficient charcoal for a radiocarbon date or sufficient samples of artifacts to be analytically useful. These were identified using observations on feature type, number of associated rocks, sizes of associated rocks, number of artifacts, and kind of artifacts from the surface collection data. The excavation and testing strategy began to focus on areas that could yield the maximum return in the shortest time.

Features were excavated with a fourth strategy, block excavation, which involved stripping areas around selected features to expose subsurface pits and collecting associated artifacts. Block excavation areas varied in size, determined in part by the size of the particular feature or artifact scatter. Initial feature testing was a minimal 1-by-2-meter unit. More commonly, a 4-by-4-meter excavation area was used. Mitigation of features often resulted in large excavation areas, occasionally over 100 square meters.

Unless stratigraphy was present, features were excavated as a single natural level consisting of the eolian deposited sands and a few centimeters of the underlying buried soil horizons. When culturally sterile soil was contacted, or when excavation depths below a given feature were deemed adequate to contain the majority of artifacts associated with that feature, excavation was terminated. Exceptions were structures where arbitrary levels were used to control vertical provenience unless natural levels were present. In a few instances where different natural stratigraphic breaks were observed, a second level was designated. Profiles were drawn of excavated features and structures, and flotation, radiocarbon, and thermoluminescence samples of burned caliche were collected where possible.

Plan views drawn of the surface and bottom of excavated levels of each feature and block excavation showed depth below datum of the bottom of an excavated level at each grid coordinate. Occasionally, the specific provenience of an artifact was recorded. Profiles were generally drawn of one wall or a section of an exposed wall of a feature or block excavation to record depths below datum of buried soils.

Twenty-eight backhoe trenches, which were on sites that were considered mitigated, were excavated to verify the lack of additional cultural evidence. All trenches were 0.75 meters wide and ranged from 10 to 20 meters long. The trenched areas covered 373 square meters, 209 within specific site boundaries and 164 near sites. Sections of all backhoe trenches on sites were profiled. Two additional backhoe trenches were placed just east of the project area to test subsurface soils in the north-south trending depression that parallels the high ridge of the southern part of the project area. None of the trenches cut through archaeological features.

Appendix C provides a site-by-site discussion of the testing and excavation strategies, and additional information on the backhoe trenches can be found in Appendix D. Artifact types and quantities from sites are listed in Appendix E and isolated artifacts are listed in Appendix F.

Artifact Patterns

Table 6.1 contains information on artifacts recovered from testing and excavation conducted on 64 sites, along with the total number of artifacts recovered, the number of 1-meter squares excavated, and the number of features tested and excavated.

Table 6.1. Artifact Types on Tested and Excavated Sites.

FB Site No.	Sq. M Excavated	Features	Ceramics	Cores	Debitage	Flakes	Ground Stone	Hammerstone	Retouched	Utilized Flakes	Tested Cores	Total Artifacts
6741 (41EP1028)	314	31	16	2	7	331	18	1	8	11	0	394
6741 (41EP1028)	314	31	16	2	7	331	18	1	8	11	0	394
7483 (41EP1037)	420	41	0	2	9	346	21	2	6	19	7	412
7484 (41EP1034)	47	7	4	1	0	8	6	0	0	0	0	19
7505 (41EP985)	17	1	0	0	1	3	4	0	0	3	0	11
7508 (41EP982)	22	3	0	0	0	3	0	1	0	0	0	4
7510 (41EP978)	80	12	4	2	1	29	15	0	1	2	0	54
7517 (41EP972)	22	6	0	0	0	4	1	0	0	0	0	5
7520 (41EP970)	34	5	0	1	1	12	10	0	0	0	0	24
7547 (41EP964)	51	7	0	3	3	64	40	1	1	1	1	114
7569 (41EP962)	16	2	0	0	0	6	0	0	0	0	0	6
7580 (41EP1753)	59	12	0	0	1	17	4	1	0	0	0	23
10409	46	2	0	0	0	0	0	0	0	0	0	0
10411	98	9	97	0	3	60	3	0	0	2	0	165
10412	52	2	3	0	1	0	0	0	0	0	0	4
10413	56	1	0	0	2	0	71	1	1	1	0	76
10414	46	1	0	0	0	11	1	0	0	0	1	13
10416	42	2	1	0	0	1	7	1	0	0	0	10
10417	68	4	16	1	2	44	23	0	1	0	1	88
10420	29	1	0	0	0	1	1	0	0	0	0	2
11298	143	3	0	0	0	23	32	0	1	2	0	58
11299	15	1	1	0	0	1	0	0	0	0	0	2
12017	42	1	0	1	1	13	3	0	0	0	0	18
12069	51	12	0	0	1	130	1	0	1	3	0	136
12072	88	12	0	0	1	16	1	0	2	0	0	20
12093	34	1	0	0	0	1	0	0	0	1	0	2
12095 (41EP4907)	23	1	0	0	1	2	0	0	0	0	0	3
12096	6	1	0	0	0	2	0	0	0	0	0	2

(Continued on next page.)

Table 6.1. Artifact Types on Tested and Excavated Sites (continued).

FB Site No.	Sq. M Excavated	Features	Ceramics	Cores	Debitage	Flakes	Ground Stone	Hammerstone	Retouched	Utilized Flakes	Tested Cores	Total Artifacts
12097	156	3	0	0	0	53	3	0	1	2	2	61
12100	285	33	56	7	5	105	13	2	0	4	3	195
12102 (41EP4908)	128	9	29	1	2	102	35	1	2	1	0	173
12213	25	1	0	0	0	0	7	0	0	0	0	7
12214	12	0	0	0	0	7	0	0	0	0	0	7
12216 (41EP4911)	72	3	0	0	0	6	1	0	1	0	0	8
12217	101	3	0	0	1	38	3	0	0	0	0	42
12218	186	6	0	0	0	68	1	0	0	5	0	74
12219	88	4	4	1	0	16	127	1	0	0	0	149
12221 (41EP4912)	13	1	0	0	0	0	4	0	0	0	0	4
12224 (41EP4913)	28	2	0	0	0	1	2	0	0	1	0	4
12225 (41EP4914)	57	4	0	0	0	4	0	0	1	2	0	7
12226	65	2	0	0	0	6	1	1	0	0	0	8
12228	24	1	0	1	2	4	0	0	0	0	0	7
12227	28	1	0	0	0	0	0	0	0	0	0	0
12229	16	2	0	0	1	14	2	0	2	1	1	21
12230	38	1	0	0	1	2	1	0	1	1	0	6
12231	8	0	0	0	0	8	0	0	1	0	0	9
12234	10	2	0	0	0	1	0	0	0	0	0	1
12237	68	1	0	1	1	110	0	0	2	4	0	118
12239	16	1	0	1	0	13	11	1	1	0	0	27
12240	10	2	0	0	0	1	0	0	0	0	0	1
12243	18	4	0	0	0	3	2	0	0	0	0	5
12245	12	1	0	0	2	33	3	0	0	0	0	38
12253	9	1	0	0	0	0	0	0	0	0	0	0
12256	54	1	0	0	0	0	0	0	0	0	0	0
12316	207	9	0	0	0	55	7	0	1	4	0	67
12318	4	1	0	0	0	0	0	0	0	0	0	0
12319	52	2	0	0	0	0	0	0	0	0	0	0
12320	9	1	0	0	0	2	1	0	0	0	1	4
12321	53	2	0	0	0	0	0	0	0	0	0	0
12324	14	2	6	0	0	0	0	0	0	0	0	6
12326	4	1	0	0	0	0	0	0	0	0	0	0
12327	42	1	0	0	0	3	0	0	0	0	0	3
12329	38	1	2	0	0	0	0	0	0	0	0	2
12330	204	13	79	1	18	132	5	0	0	2	0	237
12331	49	5	0	0	0	11	0	0	1	0	0	12
Total	4,124	308	318	26	68	1,926	491	14	36	72	17	2,968

Ceramics account for 11 percent of the recovered material, with flakes and debitage making up 67 percent of the assemblage. Ground stone, frequently fire-cracked from use in features, makes up 16.5 percent; cores, 1.5 percent; formal (retouched) tools, 1.2 percent; and informal tools (utilized flakes), 2.4 percent.

Flakes and debitage are more common in excavated context (49 percent versus 67 percent) at the project level, whereas ground stone, retouched tools, cores, and utilized flakes are more common on the surface (38.2 percent versus 21.5 percent). The differences between surface and subsurface percentages are probably a result of size differences in the artifact groups. Smaller items such as unutilized flakes occur more frequently below the surface, and larger items such as ground stone, formal tools, cores, and utilized flakes are more often on the surface.

Overall artifact density at the project level was 0.71 artifacts per square meter excavated on sites. There is considerable variability in densities, however, with several sites having subsurface densities of more than 2.0 artifacts per square meter. Several sites also had low recovery rates. Subsurface artifacts were absent on FB12256 (54 1-meter squares excavated), FB12319 (52 1-meter squares removed), and FB12321 (53 1-meter squares excavated).

Subsurface artifact density is not directly related to exposure. On sites with high levels of erosion, the average subsurface density is 0.67 artifacts per excavated 1-by-1-meter unit. On noneroded sites, the average is 0.21. When exposure is treated as a class the average subsurface densities of artifacts per 1-by-1-meter unit are 0.79 in eroded areas and 0.60 in built-up areas. Like surface densities, this pattern is somewhat counter to expectation, which was for slightly high levels of erosion to produce lower subsurface densities. These data are consistent with the suggestion that the entire project area has been eroded at some point. The built-up class is simply a depositional situation rather than a representation of deposits that are not eroded.

A comparison of subsurface artifact densities shows that the playa ridge area, which is primarily exposed, has the highest artifact density. In the 929 1-meter squares excavated in this area, 844 artifacts were recovered for an overall density of 0.91 artifacts per square meter. The northern and southern areas not associated with the playa ridge had densities of 0.65 and 0.66 artifacts per 1-meter square excavated.

Additional variables may account for these differences, including the scale at which erosion is characterized and the level of excavation intensity. Exposure of 100-by-100-meter blocks was placed in two classes for these comparisons and the information was used to identify a site as exposed or built-up. This scale may simply be too large to pick up finer patterns. In fact, surface collection data from FB7484 (41EP1034) suggest that this level of mapping is too general for these types of comparisons. Erosion does not happen without deposition, and to define the primary geomorphic character of an entire site or 100-by-100-meter block is difficult. As demonstrated in the previous chapter, though a site may be characterized as exposed, large areas of the site may, in fact, be built up. Because exposure was a primary variable in identifying archaeological remains, most of the work on any given site probably was conducted in exposed areas. Future work should consider erosion at a finer scale.

Feature Descriptions

A total of 308 features was tested and excavated by the project (Table 6.2; Appendix G). Excavation of 13 features produced evidence of modern trash. These features, most of which are in the northern grid quad that had a high level of army activity, are not considered further in this report.

Features with fire-cracked rock, burned caliche, and burned caliche/fire-cracked rock did not have subsurface pits upon excavation. Feature 1 on FB12216 (41EP4911) is an example of a burned caliche site with no subsurface stain in which most of the elements are scattered over an area approximately

Table 6.2. Excavated Feature Types.

Feature Type	Number
Stain <1 meter	124
Burned caliche/stain	65
Burned caliche/fire-cracked rock/stain	40
Burned caliche	25
Burned caliche/fire-cracked rock	21
Modern	13
Fire-cracked rock/stain	11
Stain >1 meter	7
Fire-cracked rock	2
Total	308

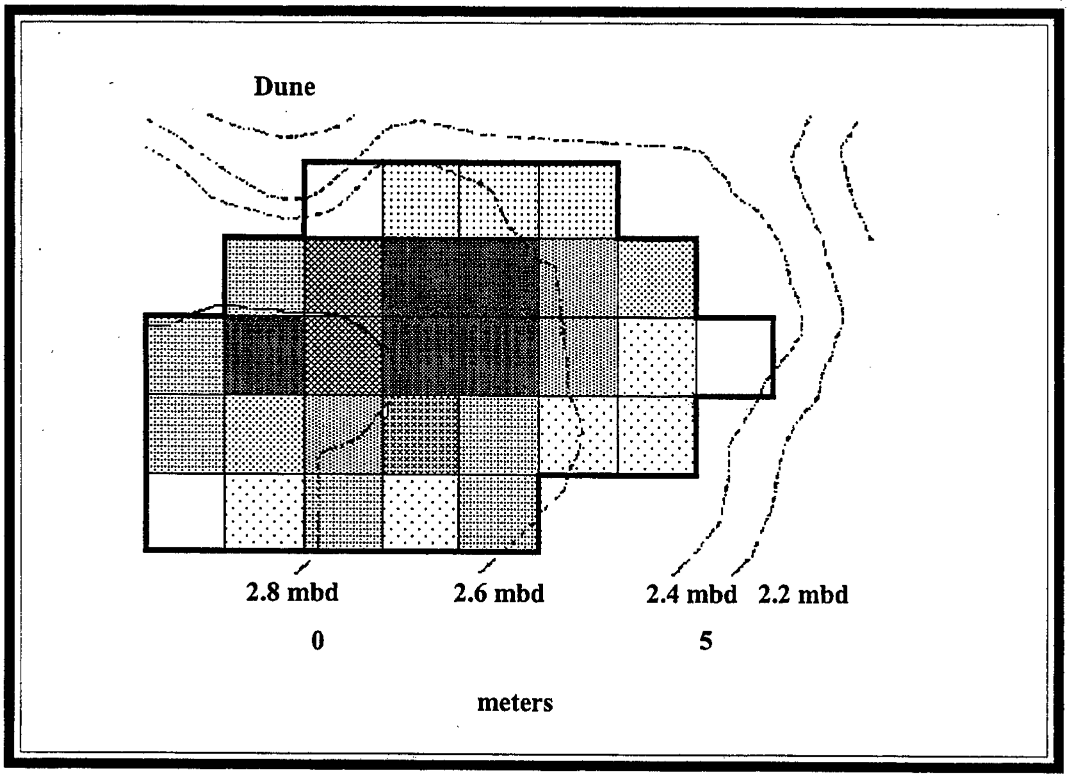

Figure 6.1. Feature 1, FB 12216 (41EP4911), Burned Caliche Site with no Subsurface Stain. Intensity of pattern corresponds with rock density.

5 by 8 meters (Figure 6.1). The rock seems to correspond to lower elevations, indicating the feature is in an isolated "blow out"; any stain that might have been associated was probably removed by the creation of the blow out. The widespread distribution of the feature is probably a result of both the erosion process and vehicular disturbance and does not indicate the original boundaries of the feature.

Sites in the large stain category included several structures and several large amorphous stains, the functions of which are unknown. The most common feature types excavated were those associated with stains. These were chosen because they had a higher probability of yielding radiocarbon dates.

For 227 features with stains, excluding large stains and internal features in structures, the most common plan view was circular (55 percent). Oval plan views accounted for 31 percent, with the remaining 14 percent classified as amorphous. Cross-sections for 221 features were basin shapes, 74 percent (Figure 6.2); cylindrical shapes, 6 percent (Figure 6.3); and amorphous shapes or lenses, 19.5 percent.

Volumes of features with pits were estimated for those not in the large stain class. The volumes of basin-shaped features with circular or oval surface shapes were estimated using an equation for one-half an ellipse; for circular, cylindrical features, volume was estimated using the area of a circle multiplied by feature depth. Estimates were compared to actual volume from several excavated features and provided an accurate reflection of the field volumes. Feature volumes ranged from less than 1 to more than 500 liters, with most being between 10 and 60 liters.

Most features were extremely shallow, with an average depth of just more than 12 centimeters, although some were as deep as 75 centimeters below the surface. The average length of all features was 58 centimeters and the average width was just more than 55 centimeters (calculations did not include large stains and features with missing measurements).

Erosion probably removed some of the upper parts of many features in the project area and affected the sizes. Features in exposed areas tended to have larger surfaces than those in built-up areas and their depths were slightly shallower (Table 6.3). The

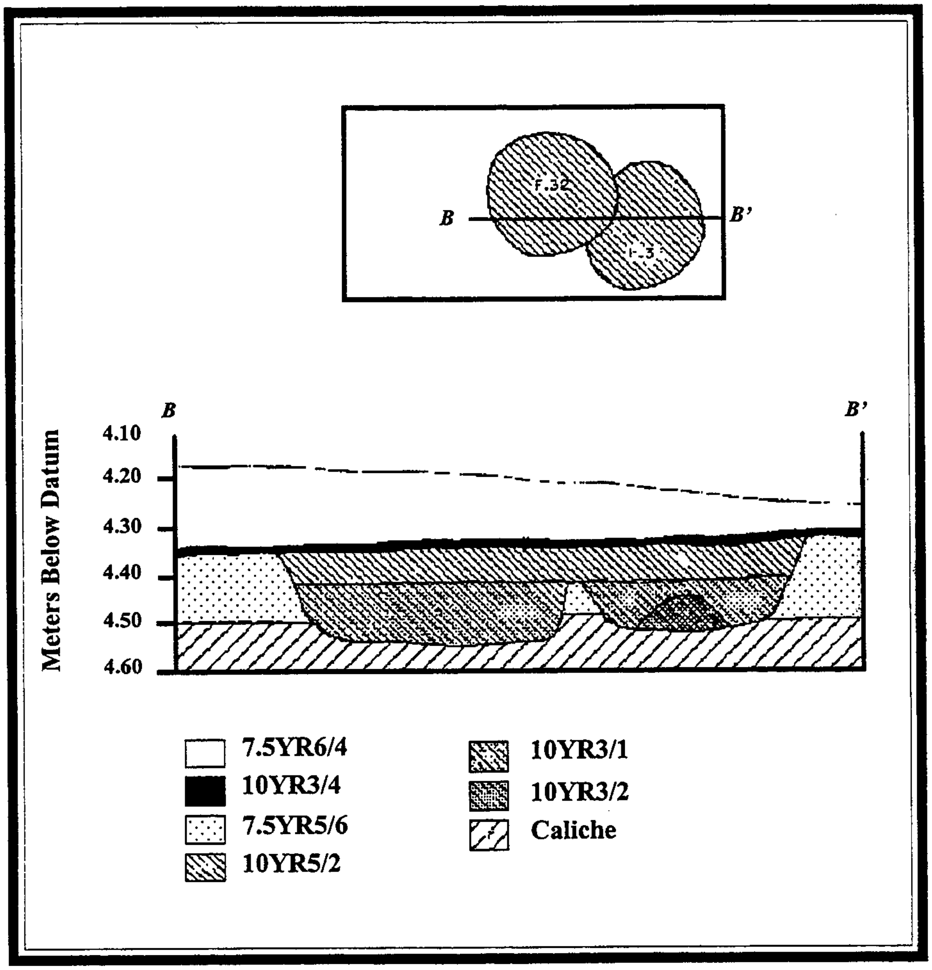

Figure 6.2. Basin-Shaped Cross Section and Circular Plan View Features (FB12100, Features 31 and 32).

dramatic size increase in exposed areas was probably the result of smearing of feature edges, which resulted in larger boundary definitions. Though minimal, features in eroded settings were shallower, an expected difference.

Table 6.3. Feature Size and Depth Relative to Exposure.

Exposure Class	Number of Features	Mean Length cm	Mean Width cm	Mean Depth cm
Exposed	124	63.50	61.60	11.96
Built up	57	45.50	42.50	12.88

Further evidence of exposure impact can be seen when the cross section data on features is correlated with erosion. Twenty-two percent of features with stains in exposed areas had a lens or amorphous cross section; only 11 percent of features in the built-up areas had this shape. There was no difference in the frequency of amorphous surface shapes relative to erosion. It appeared that features in exposed settings had been significantly affected by erosion. Note, however, that all features probably have been impacted at some point.

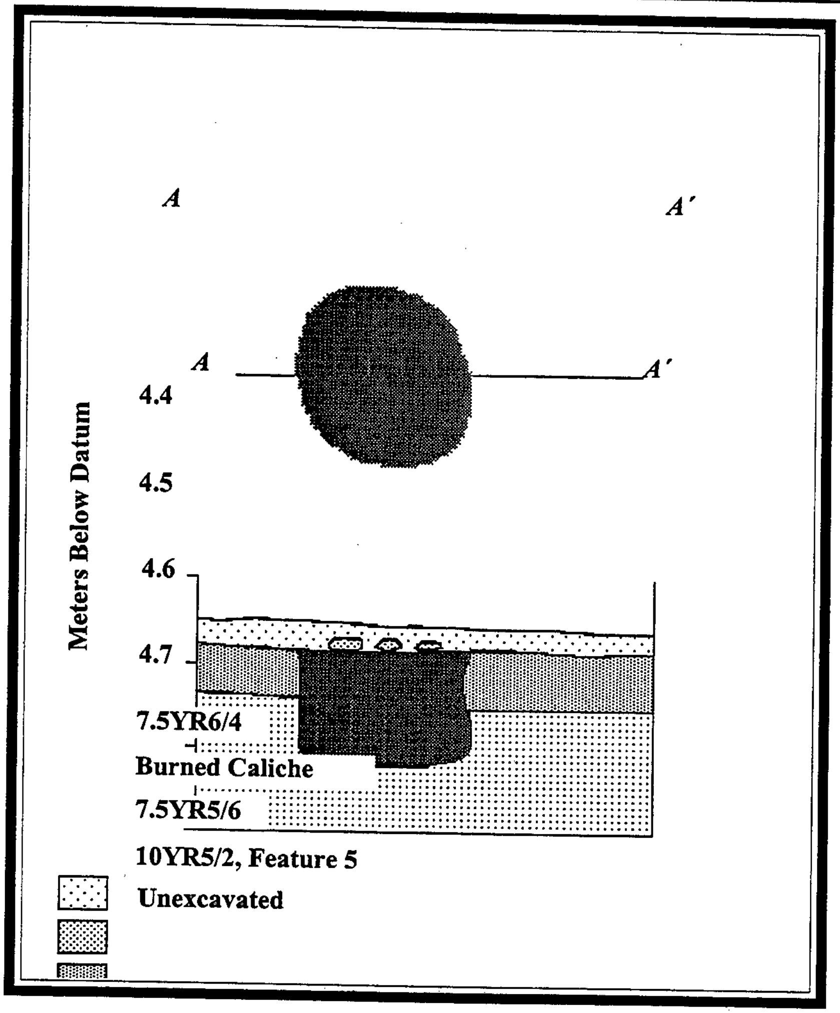

Figure 6.3. Cylindrical-Shaped Cross Section and Circular Plan View Feature (FB12330, Feature 5).

Pit Structures

Two definite pit structures, Feature 27 on FB12100 and Feature 7 on FB12330, were excavated during the project. Feature 16 on FB10411 probably represents a pit structure as well, but the feature was only tested and the exact nature of the stain remains unknown. In addition, evidence from Feature 16 on FB12069 suggests the feature may represent a structure, but it was not assigned to the structure class. Feature 15 on FB12072 was originally thought to be a structure, but probably does not represent a house. Other features also were assigned to the large stain category but most probably are eroded features or buried soil horizons and not structures.

Feature 27, FB12100

Feature 27 on FB12100 (Figure 6.4) was uncovered 5 to 10 centimeters below the surface during testing of a small ash stain, Feature 11. The top of Feature 27 was at relatively the same elevation. The D-shaped structure, which was basin shaped in cross section, had a maximum depth of 30 centimeters. The floor area was 8.1 square meters. Seventeen subfloor features were uncovered, encompassing 0.90 square meters of the floor area (Figure 6.5). No formal entry was present.

Structure fill consisted of predominately dark brown to brown (10YR4/3) ash-stained sand within

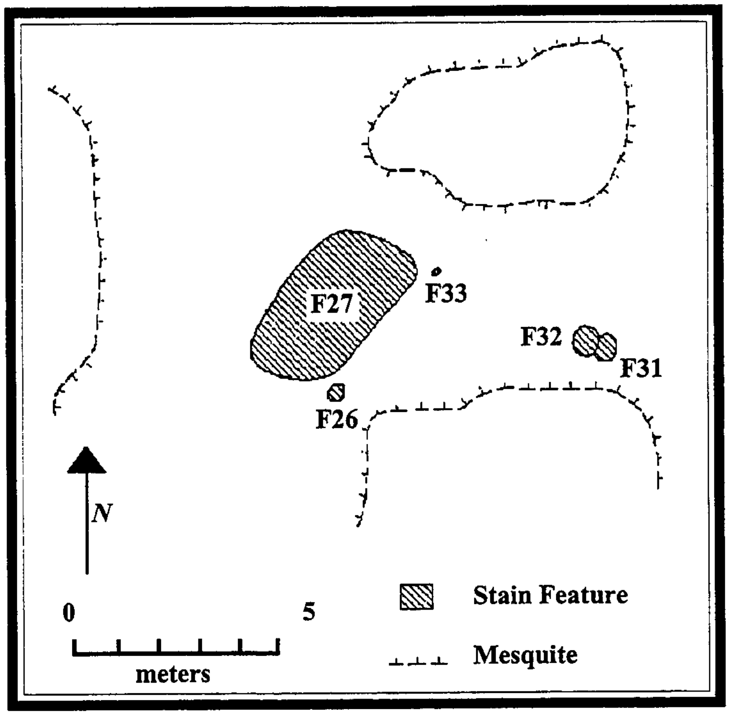

Figure 6.4. Feature 27, FB12100. The D-shaped structure, which was basin shaped in cross section, had a maximum depth of 30 centimeters.

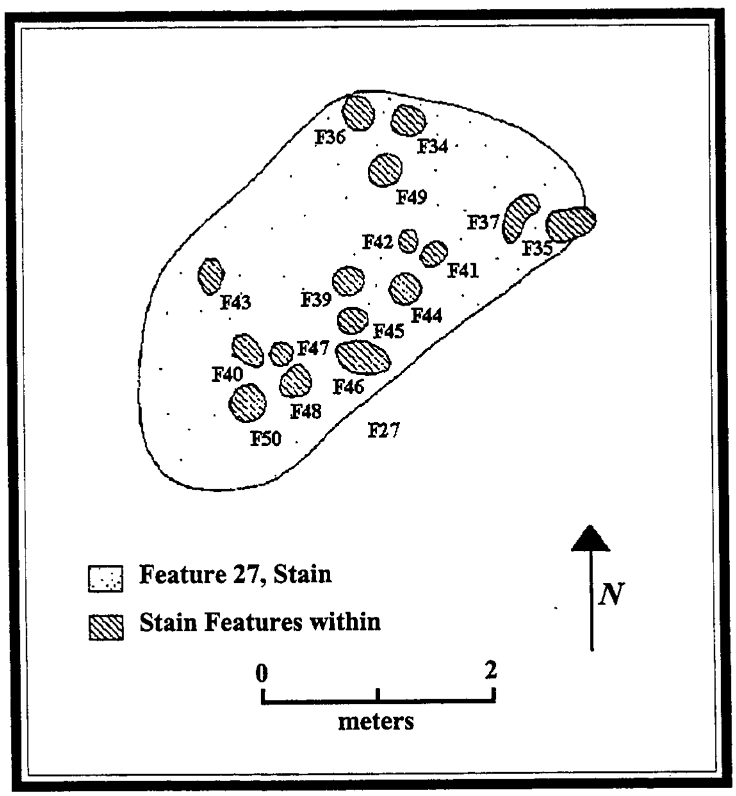

Figure 6.5. Subfloor Features in Pithouse Feature 27, FB12100.

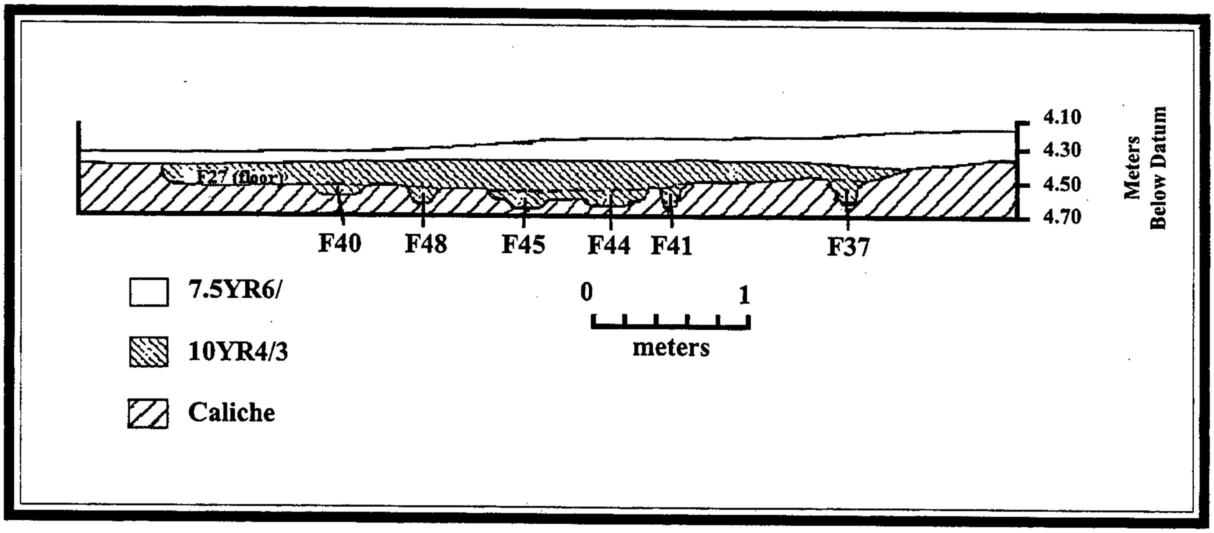

Figure 6.6. Structure Fill of FB12100.

compact strong brown (7.5YR5/6) sands; all were on top of an ash-stained, caliche-dominated soil horizon (Figure 6.6). The main part of the structure was excavated into caliche. Fill contained a low density of charcoal, gravels, and material that may be daub or roofing material. The presence of daub suggests the superstructure may have been covered with a light coating of mud.

Artifacts in the feature were lithic flakes, a unimarginally retouched lithic, a few pieces of fire-cracked rock, undifferentiated brownware ceramics, and three pieces of Mimbres Black-on-white, two of which were transitional. Many of the undifferentiated brownware ceramics in the structure fill were fitted to sherds scattered up to 5 meters east of the structure and formed a large scoop with wear along one edge. The nature of deposits and distance over which the sherds were spread may indicate that the material within the structure represented post-occupational debris.

Features 39, 44, 45, and 46 may have been floor hearths because of their central location, shape, and the extensive burning of the surrounding soil. Features 35 and 37 may have been postholes given their location and conical shape. Feature 36 in the extreme northwest corner of the structure also may have been a posthole. Features 41, 42, 47, and 48 were in the northeast and southeast parts of the structure on either side of the possible floor hearths. The shape, contents, and locations of these pits suggest they may have been postholes. Feature 43 may have been another interior posthole, though the shape is different from the others. The remaining subfloor features (Features 34, 40, 49, and 50) were relatively shallow basin-shaped ash stains of unknown function. Finally, Feature 11, identified on the surface as darker ash-stained sand, appeared to be differential roof fall from the collapsed and burned superstructure and not a separate feature.

Four ash stains were excavated outside the structure. Two were adjacent to the structure and the remaining two were 3 to 3.5 meters east by southeast of the structure (see Figure 6.4). Feature 33, a small circular, ash-stained pocket 12 centimeters deep and 10 centimeters in diameter, was 20 centimeters from the structure edge and may have been an exterior posthole or the result of rodent activity. Feature 26 was approximately 40 centimeters from the structure. The ash stain feature was a circular shallow basin with little charcoal. The general shape and location suggest it was an exterior hearth.

Features 31 and 32 were circular and basin shaped with dark ash-stained sand and large quantities of charcoal. Feature 32 was cut into the edge of Feature 31, suggesting a later date. The shape and location of these features indicate that both may have been exterior hearths. Radiocarbon analyses of dated charcoal suggest they may have been contemporary with the structure.

Three radiocarbon dates obtained on charcoal from subfloor features within the structure (Features 39, 42, 44, and 46) average A.D. 895 to 1024 at two

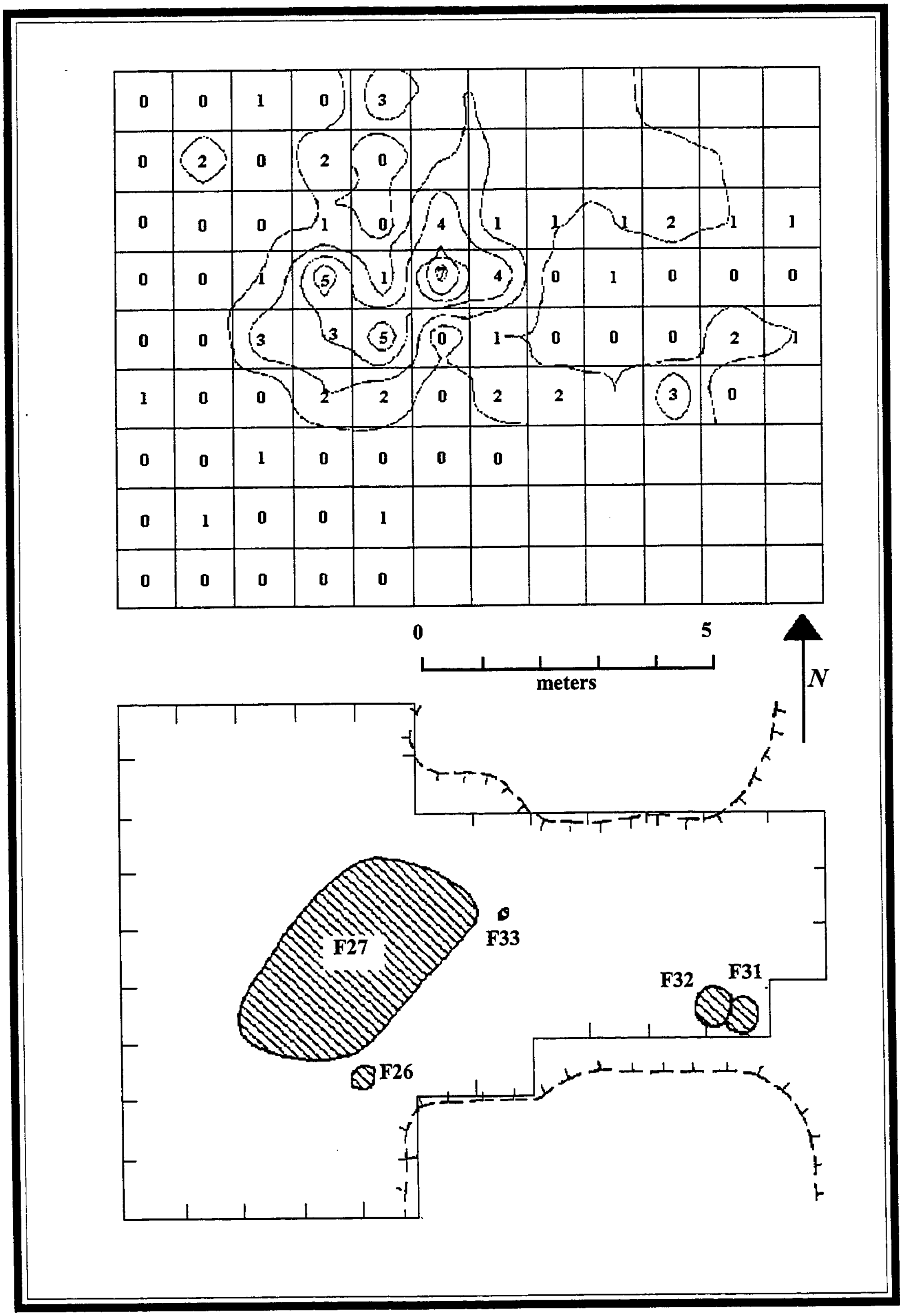

Figure 6.7. Chipped Stone Densities, Feature 27, FB12100.

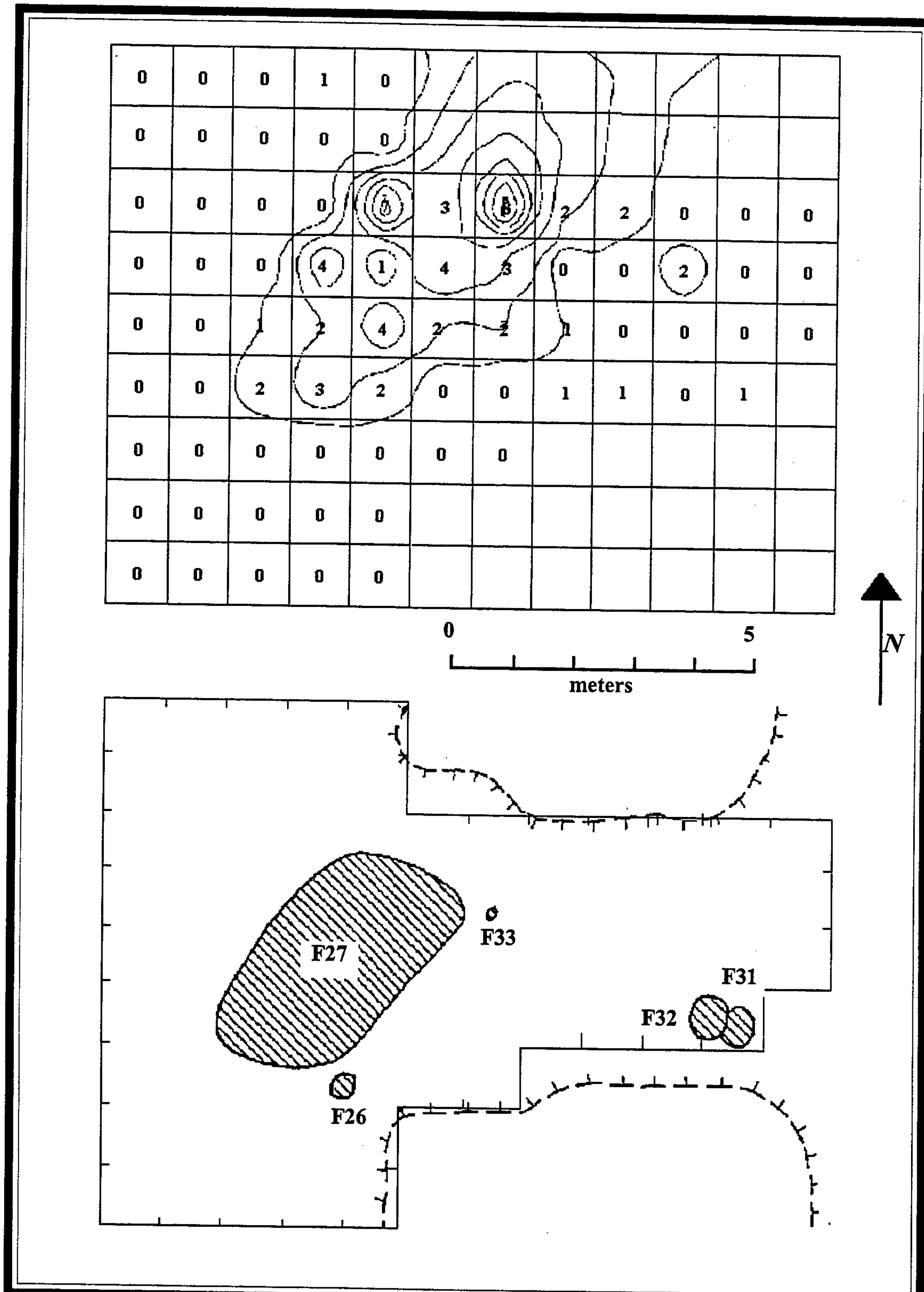

Figure 6.8. Ceramic Densities, Feature 27, FB12100.

sigmas. Radiocarbon dates from Features 31 and 32 are A.D. 694 to 1000 and A.D. 777 to 1019, respectively. These dates place the structure and associated features in the late Mesilla phase.

Comparison of density maps and plan views of Feature 27 demonstrates that chipped stone (Figure 6.7) and ceramics (Figure 6.8) were concentrated within the boundaries of the structure. Note also the low frequency of artifacts east of the structure and the ringed pattern of the lithic distribution. This low density area may have been an outside activity surface associated with Features 31 and 32; however, without further excavations, and considering the low overall artifact density, the nature of the distribution is only suggestive.

Feature 7, FB12330

Another pit structure, Feature 7 on FB12330 (Figure 6.9), was uncovered approximately 20 to 40 centimeters below the surface while testing a built-up interdunal area east of a scatter of El Paso Brown ceramics, lithic flakes, and several ground stone fire-cracked rocks. The top of the feature was defined subsurface at relatively the same vertical elevation. The circular, basin-shaped structure had a maximum depth of 29 centimeters and the floor area was 2.7 square meters. Two subfloor features were uncovered, constituting 0.22 square meters of the structure floor. No formal entry was present.

The upper part of the structure fill consisted of strong brown (7.5YR5/6) sand mixed with a small amount of charcoal. A dark brown (10YR4/4) ash-stained sand with moderate charcoal was near the floor and may represent roof fall.

Artifacts in the structure were El Paso Brown ceramics, lithic debitage and flakes, utilized flakes, and some ground stone fire-cracked rock. Many El Paso Brown ceramics recovered within the structure fill were fitted to pieces scattered up to 4 meters west. Also, sherds were fitted to others from near the bottom of the structure and from the surface outside the structure. As with Feature 27 on FB12100, this suggests that the material in the structure probably represented postoccupational fill rather than direct association with the structure.

Two subfloor features were inside the structure (Figure 6.9). Feature 12 in the south-central floor area was a circular hearth with a basin-shaped cross section. Fill was a dark gray (10YR4/1) ash with charcoal within reddish brown (5YR5/4) sand, which resulted from extensive burning. Feature 13 was a cylindrical posthole 15 centimeters in diameter and 11 centimeters in depth centrally located in the structure.

Two ash stain features were excavated outside the structure, one about 1 meter north-northeast and the other about 4 meters north-northeast. Feature 8 was a small circular and cylindrical ash stain that may have been a posthole, though it was a considerable distance from the structure and was more likely the result of rodent activity. Feature 11 was a small circular ash stain, basin shaped in cross section, at a higher elevation than the structure. The purpose of this feature, which may not have been associated with the structure, remains unknown. Three radiocarbon dates obtained from charcoal in the suspected roof fall layer average A.D. 777 to 991 at two sigmas, which places the structure in the late Mesilla phase.

Ceramic distributions showed two primary clusters, one in the structure and one to the west (Figure 6.10). The westernmost cluster was part of the assemblage that originally led to the decision to excavate in this area. Like the previous structure, a dense cluster of lithic material was centered in the house (Figure 6.11). A northwest trending pattern of lithic material west of the structure correlated with vehicular traffic through the excavation area.

The concentration of material within the confines of the structure almost certainly represented postoccupational debris. The relationship between the material in the structure and the use of the structure remains unknown as the processes responsible for the deposition of the artifacts in the structure are unclear. Significant artifact accumulations were near the floor (Figure 6.12) and several of the denser layers near the bottom were below the probable roof fall zone. These could have been related to the structure, except that ceramics were fitted to pieces on the surface several meters outside the structure.

Feature 16, FB10411

One other probable structure, Feature 16 on FB10411 (Figure 6.13) was uncovered during the testing phase of the project. A 1-by-12-meter trench was excavated through a darker surface soil anomaly on built-up sands in the central site area where a few lithics, bones, and small pieces of burned caliche were recovered from the surface.

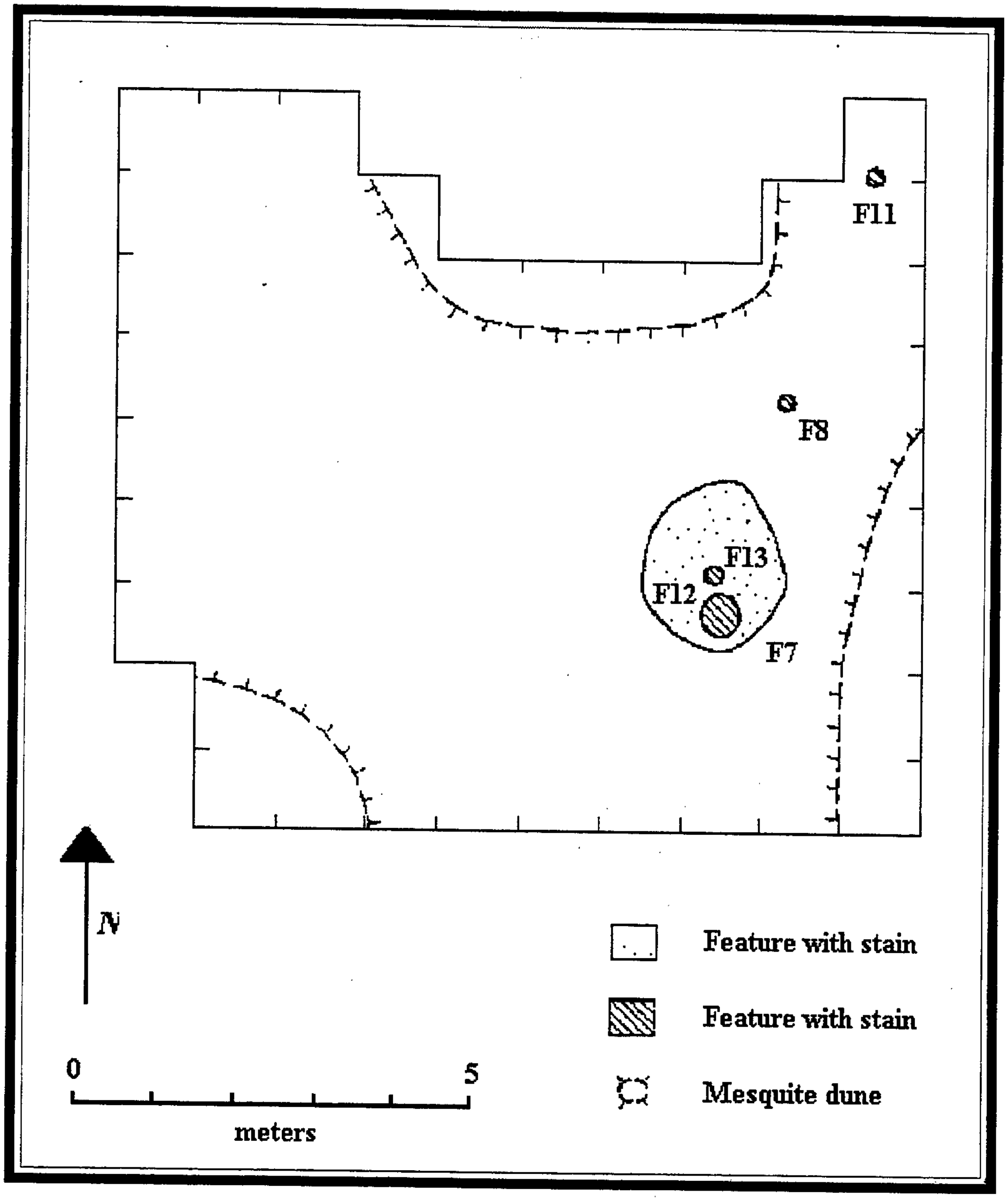

Figure 6.9. Pithouse, Feature 7, FB12330.

Excavation of the trench with a single 1-by-1-meter unit revealed cultural sediments that extended 60 to 80 centimeters below the surface to a possible floor. Excavations were continued to the north and south to uncover more of this anomaly. Soil within the excavation trench consisted of a dark brown (7.5YR4/4) ash-stained sandy loam with some charcoal, small gravels, lithic flakes, and burned and unburned bone. The area was extensively disturbed by rodent activity.

Close examination of the exposed east and west profile walls of the trench revealed a 2.5-meter-wide stain, which may have been the remains of a structure, in the western wall of the trench. The extent of the stain corresponded to a nearby concentration of lithic artifacts. Outside the stained area, cultural materials decreased dramatically in density and the sediments turned to dark brown sands. Edges of the feature were not visible in the eastern trench wall.

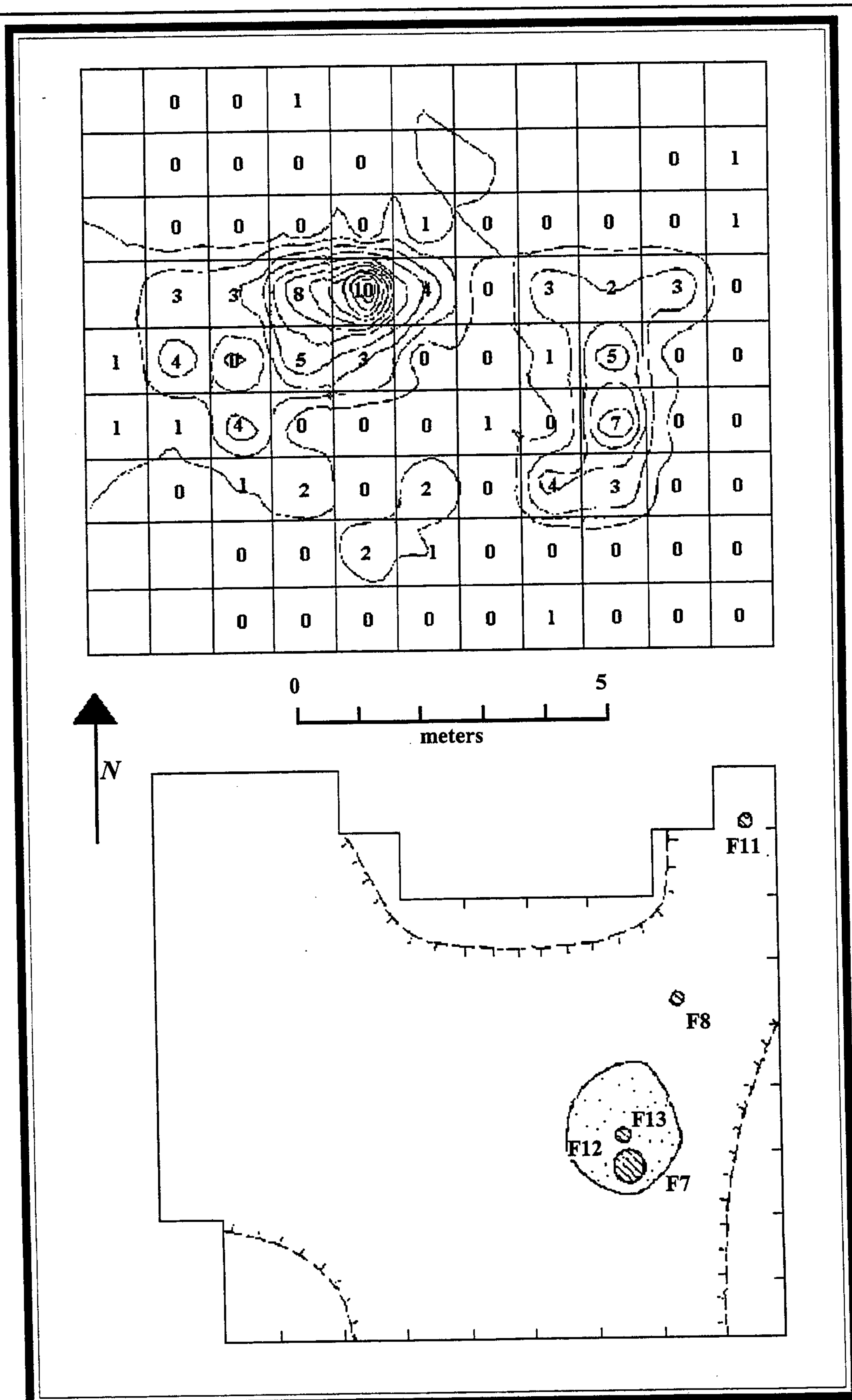

Figure 6.10. Ceramic Densities, Feature 7, FB12330.

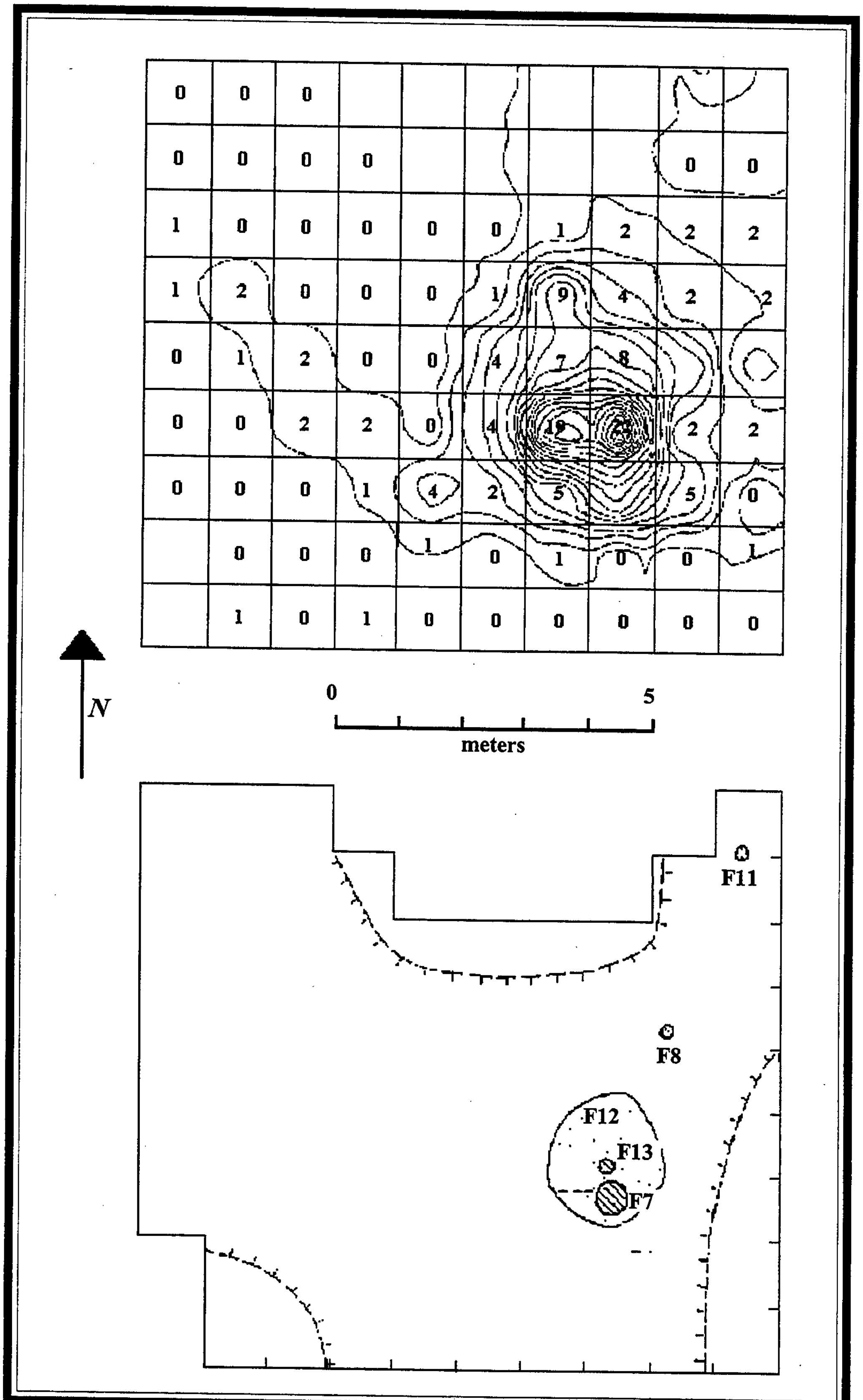

Figure 6.11. Chipped Stone Densities, Feature 7, FB12330.

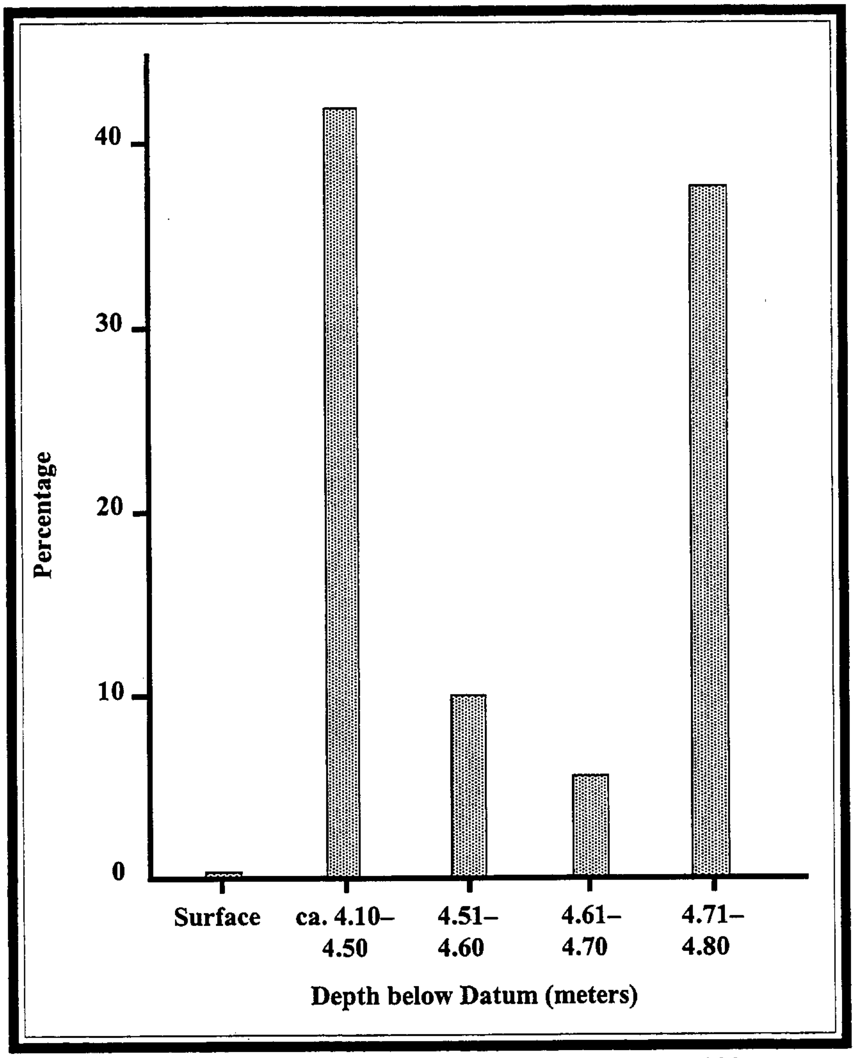

Figure 6.12. Artifacts Associated with Feature 7, FB12330.

A series of auger holes excavated perpendicular to the hand-excavated trench to determine the extent of the feature documented the darker soils 2 meters to the east and about 5 meters to the west at relatively the same depths below datum. A defined edge to Feature 16 was not revealed by the augering, though the darker sediments rose 2 meters to the east of the trench.

Feature 16 on FB10411 probably represented an El Paso phase pit structure. A single radiocarbon date from Feature 16 provided an average date of 635 B.P. at two sigmas (A.D. 1315). Interestingly, the structure area lacked ceramics, though it provided an El Paso phase date and had numerous artifacts in the fill. El Paso phase ceramics were plentiful on the site, with a concentration located immediately north of the excavation.

Feature 16, FB12069

Another structure may have been present at FB12069, though the evidence was circumstantial (Figure 6.14). This possible house, Feature 16, was a thin lens often no more than 1 centimeter thick. Other features, several of which provided radiocarbon dates between 1300 and 1520 B.P., are in the area. The size of the stain was similar to other structures in the area, but without a definitive edge in several areas, and several features may crosscut the extant edge. Military traffic had impacted the exca-

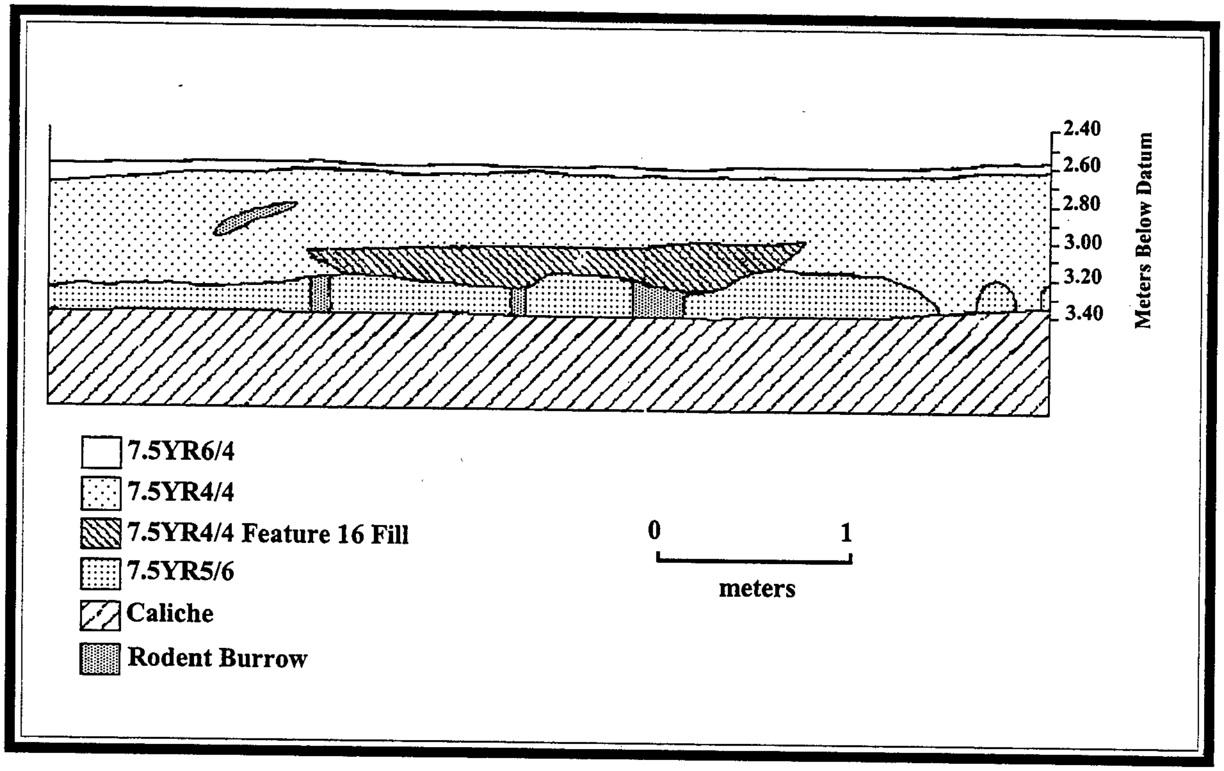

Figure 6.13. Probable Structure, Feature 16, FB10411.

vation area, further complicating clear-cut recognition of stain boundaries.

Artifact density contours (Figure 6.14) demonstrate a series of high density clusters, all within the Feature 16 boundary. The distributional pattern is similar to the two definite pit structures discussed above. However, the lack of a clearly defined edge, the shallow nature of the stain, and the lack of clear postholes makes concrete assignment of this feature to the structure class unwarranted.

Feature 15, FB12072

Feature 15 on FB12072 (Figure 6.15) was a large stain originally thought to represent a pit structure (Mauldin and Graves 1991). Like Feature 16 on FB12069, the boundary was unclear and the feature was extremely shallow. Subsequent investigation during the excavation phase suggested that Feature 15 probably represented the deflation of Feature 20, which was below it. The depths of Feature 6 to the west and Feature 20 were similar, about 4.30 meters below datum, but Feature 6 was much shallower (Figure 6.16). The bottom depths of Features 17, 18, and 19 also were around 4.30 meters below datum and were similar in depth below the surface to Feature 6. Features 6, 17, 18, and 19 were exposed on the surface. All were in eroded areas and some parts of the tops of the four features probably had been removed. Feature 20 was in a built-up area and uncovered while tracing the outlines of Feature 15. Although dug to a similar depth below datum, the depth of the feature below surface was greater than the four features to the west. Feature 15 may have represented the initial stages of the exposure of Feature 20 rather than a structure because of the similarity in the bottoms of the features, the lack of definition on Feature 15, and the built-up setting of Feature 20. This interpretation is consistent with the thin, amorphous shape of Feature 15. Artifact densities in the area tend to support this conclusion. Nineteen artifacts were in the 71 1-meter squares of excavation, and only six were within the boundaries of Feature 15. This pattern is unlike those identified for the definite structures described above where artifacts often were concentrated within structure boundaries.

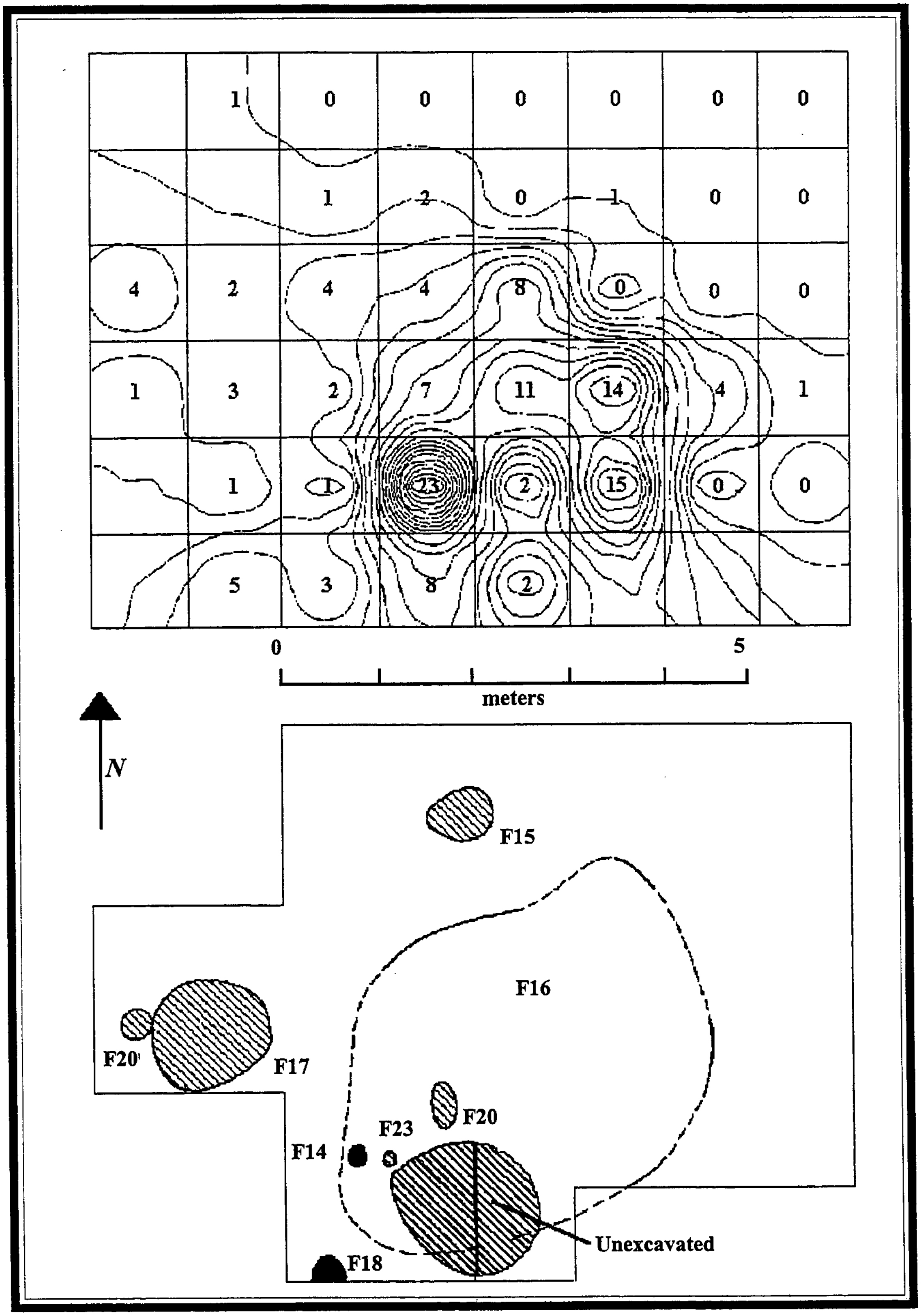

Figure 6.14. Possible House, Feature 16, FB12069.

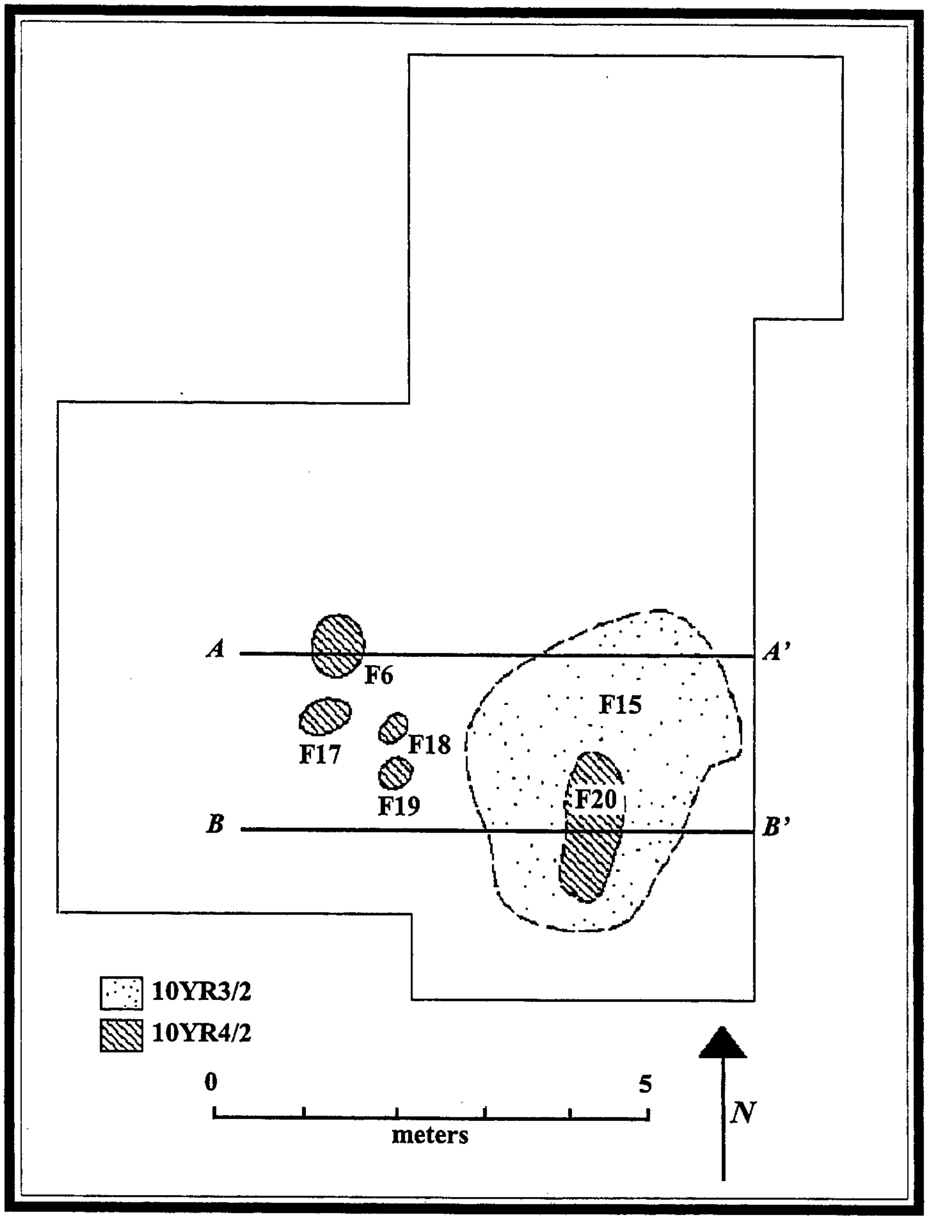

Figure 6.15. Feature 15 on FB12072.

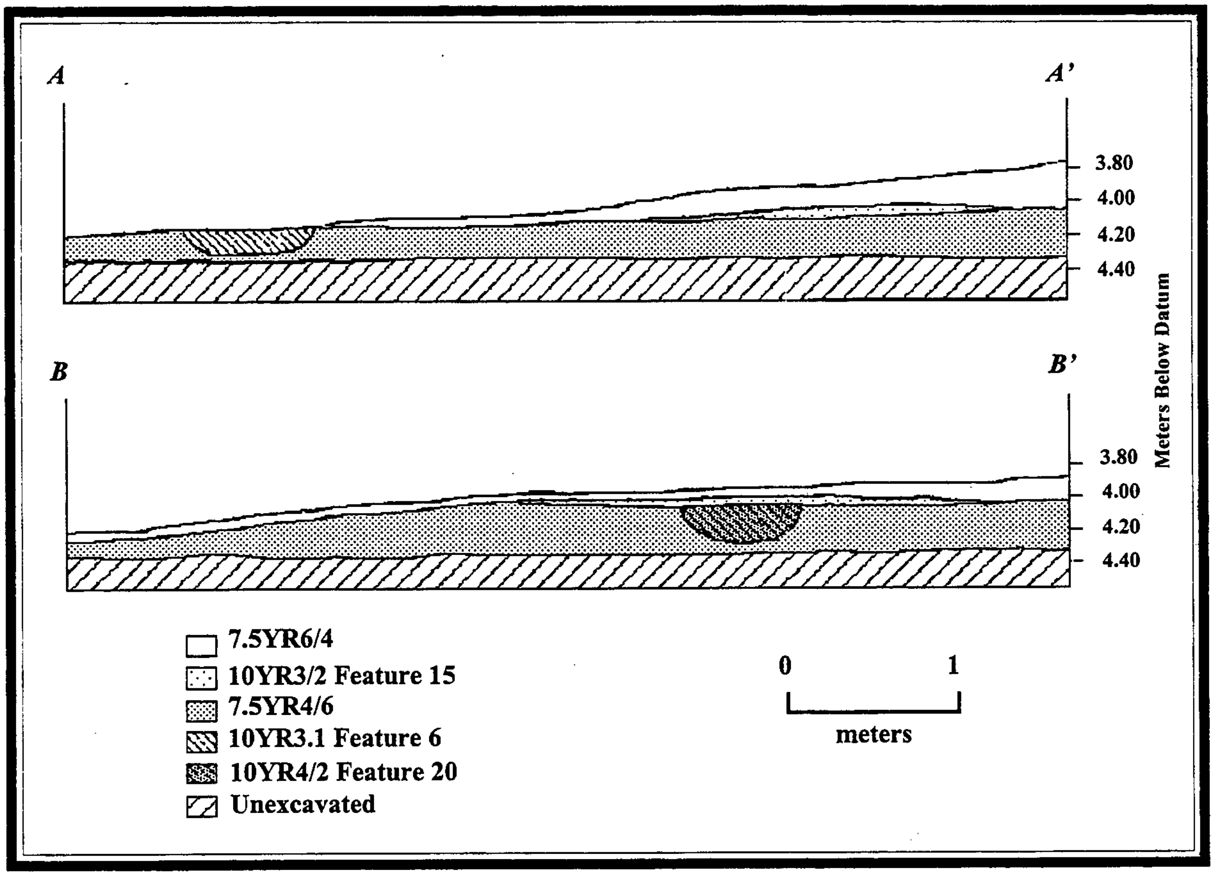

Figure 6.16. Feature Depths, FB12072.

Cluster Excavations

Clusters of artifacts within sites, defined by Euclidean distance, may form a more realistic unit of analysis for surface material than site boundaries. Ideally, large areas of surface clusters would have been excavated, providing data for a variety of comparisons between both surface and subsurface assemblages. Unfortunately, the clusters were defined after testing and excavation was well underway. Both testing and excavation focused on features that had a high probability of yielding a date and were in areas needed for military training.

Several excavated clusters, especially on FB6741 (41EP1028), had widespread 1-by-1-meter units throughout. However, a 1-by-1-meter unit, given the low density of material on these sites, did not provide an adequate sample of material, and, unless a feature was uncovered during testing, never provided a radiocarbon date. Feature tests, generally using the block testing method, were conducted in 48 of the 282 clusters. Only 21 yielded radiocarbon dates. This low frequency of excavation in surface clusters made direct comparison of cluster patterns with excavation material difficult.

Significant differences in size, and therefore artifact content, of surface and subsurface assemblages further exacerbated this difficulty. Surface assemblages have a higher percentage of items that tend to be larger (for example, ground stone, cores, retouched tools), and subsurface assemblages have a higher percentage of smaller artifact types (for example, lithic debris). The average size of chipped stone from surface contexts is 2.62 centimeters with a median of 2.10 centimeters. Subsurface chipped stone material averages 1.29 centimeters with a median of 0.95 centimeters.

Block Excavations

Block excavation areas formed the primary unit of analysis for excavated material. Sixty-six blocks with an average area of just over 36 square meters of excavation yielded a total of 2,336 artifacts, including ground stone. These blocks accounted for almost 79 percent of all recovered excavated material with an average recovery of 35.4 specimens per block. The density of artifacts per meter of excavation varied between 0.09 and 5.42 (Table 6.4). Surface artifacts, from outside the excavation area and within a few meters of the excavation boundaries, averaged only 5.6 per block (N = 386). Nineteen of the 66 blocks had radiocarbon dates.

Table 6.4. Block Level Information.

Block Number	Site	C-14 Dates (#)	Excavated Area (sq. m)	Excavated Artifacts (#)	Surface Artifacts (#)	Excavated Densities (#)
1	FB6741 (41EP1028)	1	19	103	2	5.42
2	FB6741 (41EP1028)	1	126	54	5	0.43
3	FB6741 (41EP1028)	0	9	13	2	1.44
4	FB6741 (41EP1028)	0	9	30	0	3.33
5	FB6741 (41EP1028)	0	6	9	26	1.50
6	FB7483 (41EP1037)	0	17	5	2	0.29
7	FB7483 (41EP1037)	1	79	89	13	1.13
8	FB7483 (41EP1037)	0	17	10	1	0.59
9	FB7483 (41EP1037)	0	14	14	2	1.00
10	FB7483 (41EP1037)	1	28	101	1	3.61
11	FB7483 (41EP1037)	0	29	38	17	1.31
12	FB7483 (41EP1037)	0	45	24	18	0.53
13	FB7483 (41EP1037)	0	12	8	1	0.67
14	FB7483 (41EP1037)	0	16	11	0	0.69
15	FB7483 (41EP1037)	1	103	56	6	0.54
16	FB7505 (41EP985)	0	17	11	5	0.65
17	FB7510 (41EP978)	0	10	5	5	0.50
18	FB7510 (41EP978)	0	8	39	9	4.87
19	FB7520 (41EP970)	0	12	32	23	2.67
20	FB7547 (41EP964)	0	8	12	0	1.50
21	FB7547 (41EP964)	1	12	29	2	2.42
22	FB7547 (41EP964)	0	15	43	12	2.87
23	FB7547 (41EP964)	1	12	30	1	2.50
24	FB7569 (41EP962)	0	16	6	0	0.37
25	FB7580 (41EP1753)	1	16	17	1	1.06
26	FB7580 (41EP1753)	1	19	6	10	0.31
27	FB10411	1	32	61	6	1.91
28	FB10411	0	19	4	5	0.21
29	FB10413	0	56	76	7	1.36
30	FB10414	0	42	13	0	0.31
31	FB10416	0	36	9	1	0.25
32	FB10417	0	16	6	2	0.37
33	FB10417	0	12	24	6	2.00
34	FB10417	0	16	9	11	0.56

(Continued on next page.)

Table 6.4. Block Level Information (continued).

Block Number	Site	C-14 Dates (#)	Excavated Area (sq. m)	Excavated Artifacts (#)	Surface Artifacts (#)	Excavated Densities (#)
35	FB11298	0	125	58	11	0.46
36	FB12069	1	42	133	0	3.17
37	FB12072	1	71	18	2	0.25
38	FB12097	0	17	20	1	1.18
39	FB12097	0	39	16	0	0.41
40	FB12097	0	97	22	2	0.23
41	FB12100	1	71	126	10	2.00
42	FB12100	1	37	14	3	0.38
43	FB12100	0	16	47	2	2.94
44	FB12100	0	103	5	0	0.05
45	FB12102 (41EP4908)	0	16	9	4	0.56
46	FB12102 (41EP4908)	0	15	10	0	0.67
47	FB12102 (41EP4908)	0	31	88	14	2.84
48	FB12102 (41EP408)	1	20	28	0	1.40
49	FB12217	0	81	34	7	0.42
50	FB12218	0	100	61	6	0.61
51	FB12218	0	32	7	1	0.22
52	FB12219	0	40	70	18	1.75
53	FB12219	0	24	74	11	3.08
54	FB12225 (41EP4914)	1	57	7	1	0.12
55	FB12228	0	20	7	0	0.35
56	FB12229	0	7	11	24	1.57
57	FB12230	0	38	6	1	0.16
58	FB12237	0	17	28	4	1.65
59	FB12237	0	35	72	5	2.06
60	FB12239	0	16	27	8	1.69
61	FB12245	0	12	38	0	3.17
62	FB12316	1	44	4	4	0.09
63	FB12316	0	88	60	8	0.68
64	FB12330	1	46	4	0	0.09
65	FB12330	1	76	223	19	2.93
66	FB12331	0	48	12	0	0.25
Total		19	2,384	2,336	368	

One excavation block, Area 2 on FB6741 (41EP1028) covered 126 1-meter squares (Figure 6.17) and contained 54 artifacts, most of which were chipped stone. Several of the five concentrated areas seemed to correspond with the locations of features. Radiocarbon dates from Features 7 and 152 in the northeast feature cluster place the area in the late Archaic between 2200 and 2500 B.P. However, a single brownware ceramic, recovered near the center of the block, dates sometime between 1700 and 500 B.P., considerably after the radiocarbon dates to the northeast, and was associated with a distribution of lithics. If both the radiocarbon dates are correct, either the sherd is intrusive and not associated with the rest of the cluster or the radiocarbon dates assign only the northeastern artifact concentration to the late Archaic. Because there were no additional sherds, there is reason to suspect that the sherd was intrusive.

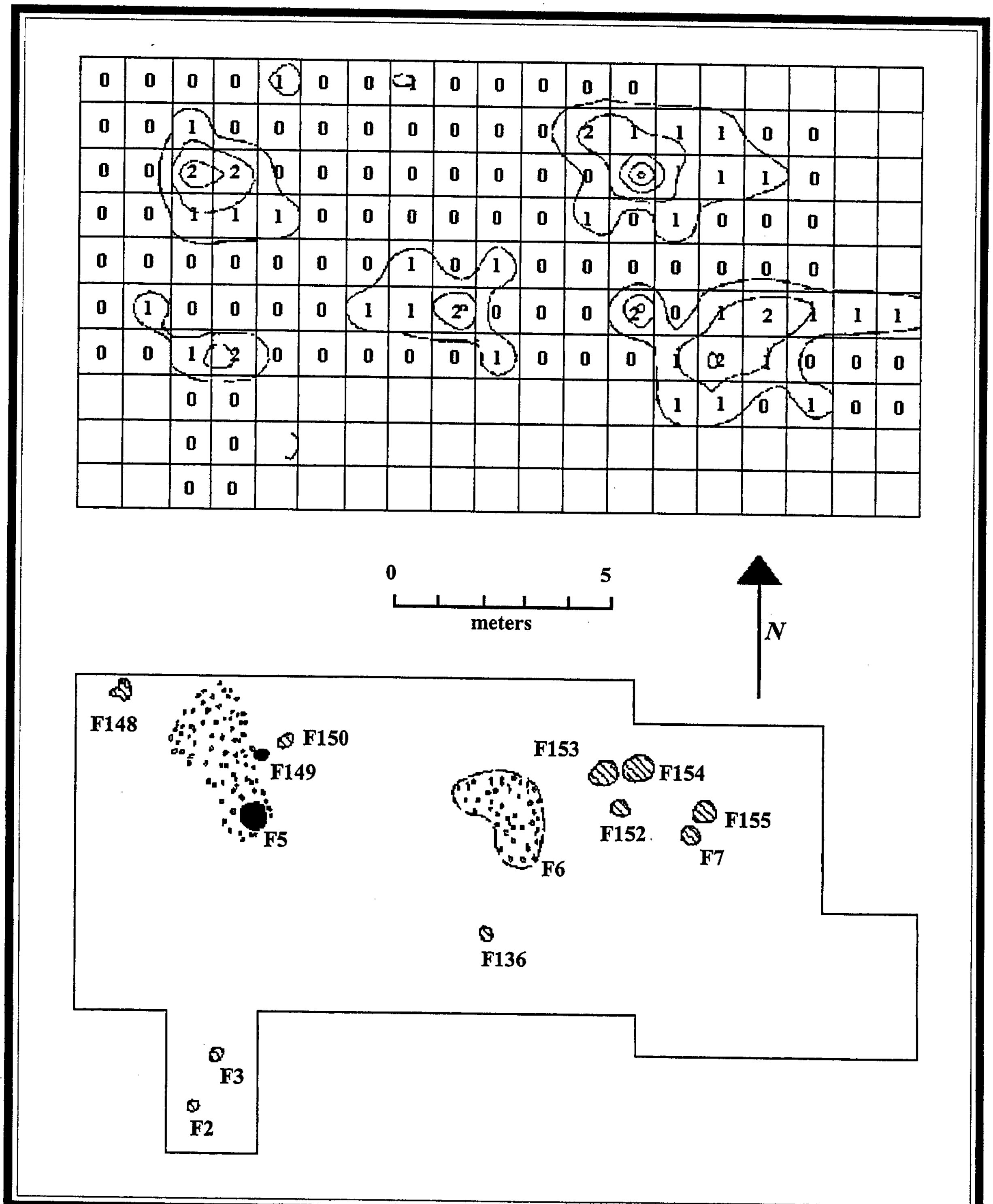

Figure 6.17. FB6741 (41EP1028), Area 2. Chipped stone densities in the top part of the figure are compared with features (hachured areas) and fire-cracked rock concentrations (dots) in bottom figure.

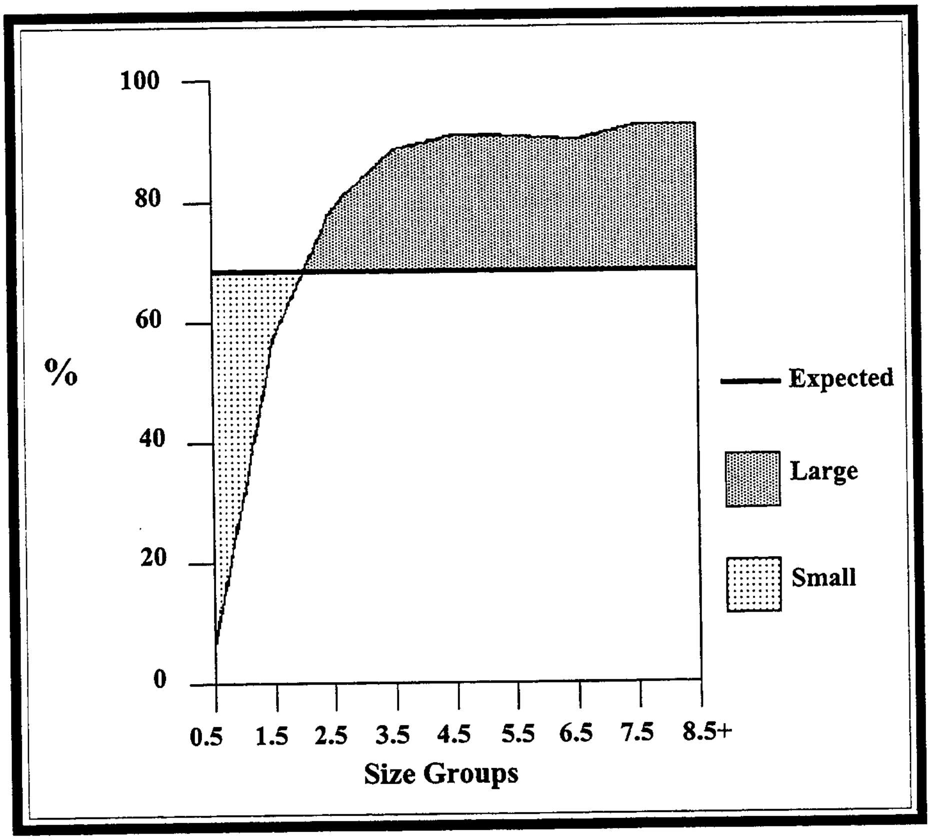

Figure 6.18. Lithic Sizes at Project Level and Expectations for Surface Percentages.

Nevertheless, the excavation block may have contained several functional and or temporal associations. Thus, even at a block level, a number of temporally discrete, and possibly functionally different, occupations may be present.

Excavated Material Analysis Units

Figure 6.18 illustrates the differences between chipped stone size at the project level and expectations for surface percentages of lithics. The expected percentage line is derived from the overall percentage of surface lithic items on the project. That is, 68 percent of the 6,748 chipped stone items were recovered from the surface and 32 percent were recovered subsurface. If there is no size difference between the surface and subsurface assemblages, the percentage of lithics within a given size group for the surface should consistently hover around 68 percent. This is not the case, however. Lithic items in the smaller ranges are underrepresented on the surface, whereas those in the larger size ranges are consistently overrepresented.

Figure 6.19 demonstrates similar data for ceramics. Initially, the curve tends to follow a line similar to that of the chipped stone debitage with small sized items less common on the surface than would be expected, and conversely more common subsurface. Like lithics, at a size range between 1.5 and 2.5 centimeters ceramics become increasingly common on the surface; however, unlike lithics, the largest ceramics are less common than expected on the surface. One possible explanation for the lower than expected frequency may be breakage. Ceramics are much more fragile and easily broken by foot traffic, cattle, and 60-ton tanks. The larger surface ceramics may be constantly exposed to breakage, resulting in the reduction of this size range on the surface.

The precise reasons for underrepresentation of small items on the surface are not known. Clearly, visibility may have an impact on the recovery of

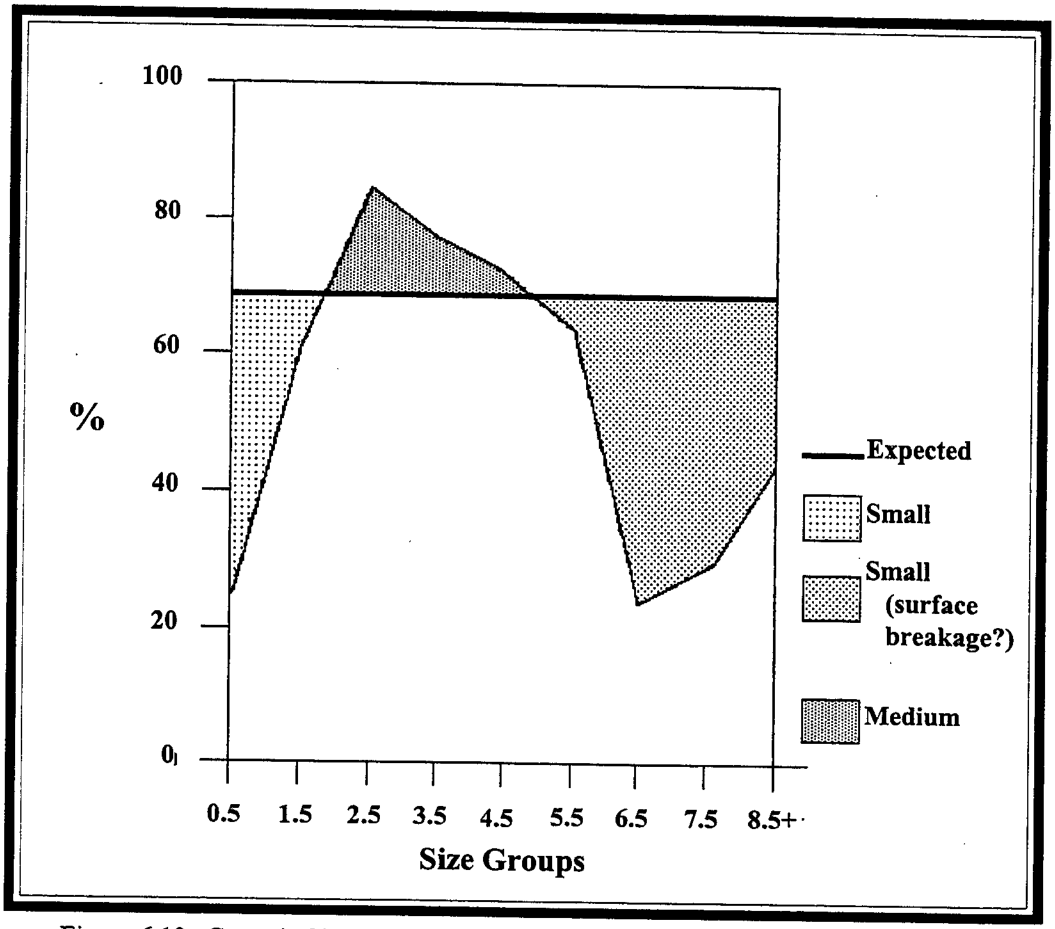

Figure 6.19. Ceramic Size at Project Level and Expectations for Surface Percentages.

smaller items on the surface. Also, smaller items are more likely to be covered by eolian deposits than larger items, and thus less likely to be recovered. Simms (1984) and Wandsnider (1988) document the horizontal movement of artifacts as well as the underrepresentation of smaller items on the surface. Whatever the reason for the disproportionate material sizes, the process affects assemblage composition, as demonstrated by the comparisons of surface and subsurface assemblages.

More important than this absolute difference, however, is the influence of specimen size within an artifact class on an assemblage. For example, a collection dominated by small lithic debris probably will contain a lower percentage of cortex, a higher percentage of broken and thin flakes, and a higher percentage of fine-grained raw materials that are more likely to be involved in tool maintenance activities. All the attributes have interpretive implications for an assemblage. To find an assemblage with a higher frequency of cores, large flakes, hammerstones, and course-grained materials—an assemblage that may be interpreted as indicating early reduction activities—look at the surface of a site. To find evidence of later reduction activities, excavate the same site and compare it with the surface assemblage.

Figure 6.20 compares the relative frequency of various artifact types to their average sizes. Artifact types with an average length of more than 2 centimeters were consistently more frequent on the surface, whereas those with an average size of less than 2 centimeters were fewer than expected. The different artifact types are divided by size, which further complicates any surface or subsurface assemblage.

Comparisons of assemblages without regard to comparable excavation levels may reveal more about the sizes of recovered materials than about behaviors that produced the assemblages. This size phenomenon has significant implications for developing effective sampling techniques for small sites, as well

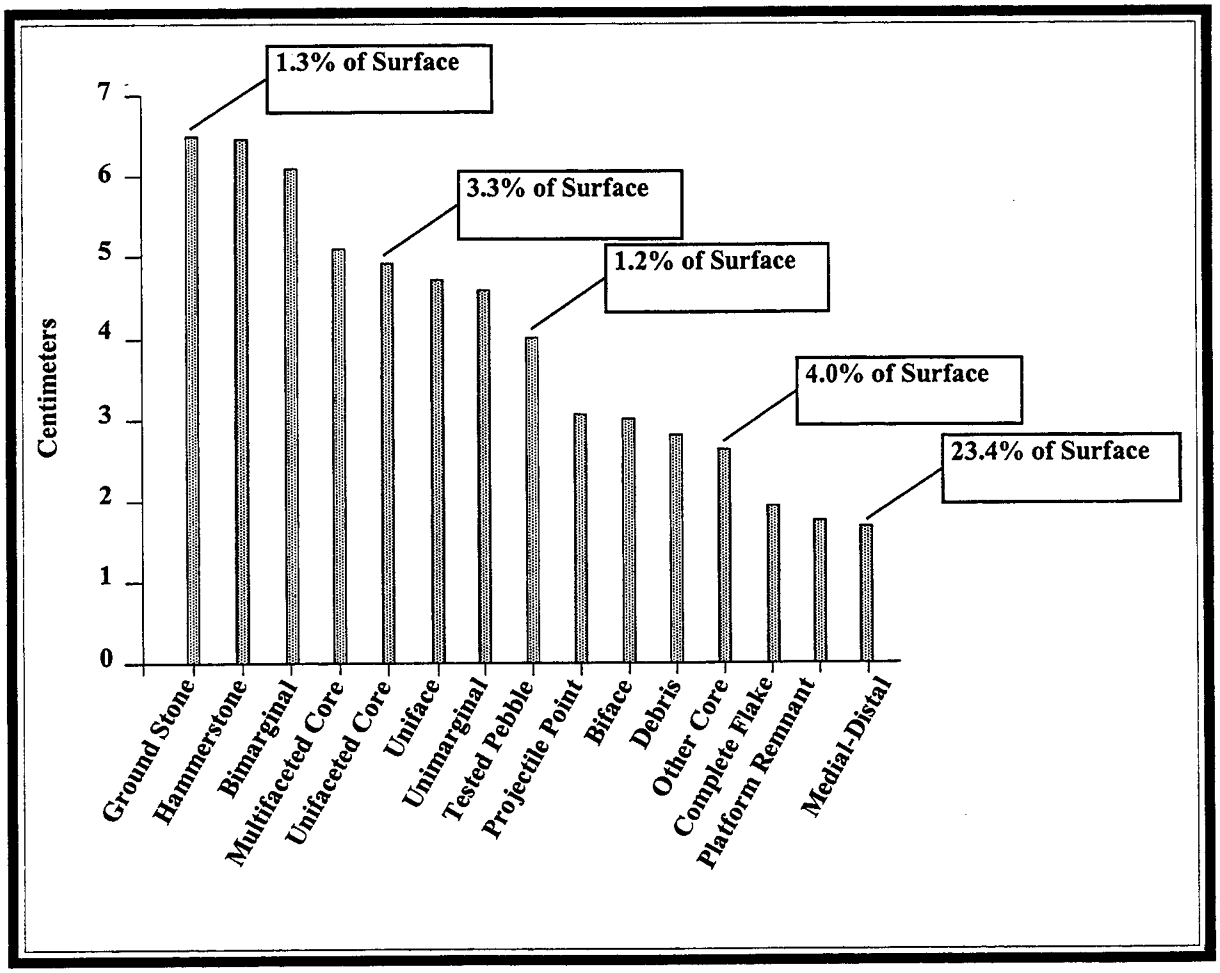

Figure 6.20. Average Artifact Sizes with Expected Surface Percentages.

as for the interpretation of these assemblages. If the goal is to understand the overall composition of site assemblages, some level of testing and attention to the geomorphic context of the surface and test unit locations will be required.

The size phenomena further complicated direct comparison of surface and subsurface assemblages at similar levels. Where adequate levels of excavation within clusters were available, such comparisons were made. However, in most cases, the cluster data and the block feature excavation data did not overlap because clusters were not identified until after testing and excavation was underway.

SUMMARY

A total of 4,161 1-meter squares was hand excavated on 64 sites in the southern and northern sections of the project. An additional 31 1-meter squares were excavated outside site boundaries. Thirty backhoe trenches were cut in these areas and 91 auger holes were placed in sites.

Artifacts found during excavation comprised 2,968 ceramics, lithics, and ground stone, with the highest subsurface density being along the playa ridge area. Three hundred and eight features were excavated or tested, including two definite pit structures and several possible structures.

Comparisons of artifact sizes in surface and subsurface assemblages suggest that the subsurface material is significantly smaller than the surface assemblage. Because a limited number of extensive surface tests were used to define clusters, any direct comparison between surface clusters and excavated

material is difficult. Sixty-six excavation blocks that had some level of horizontal exposure and a moderate number of artifacts were defined. The blocks, which contained almost 79 percent of all subsurface artifacts, formed the primary analytical unit for investigating the excavated assemblages. Within a given block, additional analytical units were defined by artifact distribution. Nineteen of these blocks have radiocarbon dates. However, evidence suggests that when only a few radiocarbon dates are available, the dates may not provide temporal control for all material within a block. Thus assigning temporal affiliation to artifact materials in a block, even with radiocarbon dates for a given feature, is still problematic.

Chapter 7

CERAMICS

More than 1,000 sherds were collected from sites in the project, with 691 (68 percent) coming from the surface and 326 from excavation; 23 of the collected sherds were isolated artifacts. Ceramic analysis was limited by the small number of sherds, especially rim sherds; the small sherd sizes; and the generally eroded condition of the assemblage. In addition, most ceramics were concentrated at a few loci. In spite of these problems, analysis results suggest that project assemblages may be qualitatively different from those of some larger sites in the region.

Analytical Methods and Results

The primary concern of ceramic analysis was to gain insight into the ranges of activities conducted at the project scale and at smaller scales within the project, especially the surface cluster and block excavation levels. Analysis included:

- Identification of ceramic type
- Identification of sherd element (rim or body)
- Tentative classification of sherd (bowl or jar)
- Measurements of maximum length and weight
- Estimates of orifice diameter on rim sherds

Initial attempts to monitor temper types and sizes resulted in no discernible patterns in either variable.

Identification of type and element followed the established ceramic typology for the region. Possible vessel form was determined by the degree of smoothing on the interior sherd surface and the sherd's curvature. Specimens having smooth interior surfaces were assigned to the bowl class, and those with rough interior surfaces were classified as jars. This method of classification assumed that bowls, which necessarily have large orifice diameters allowing easier access, were more likely to be smoother on their interior surfaces than jars, which have more restricted access. Extremely small sherds (fingernail size and smaller) and those having extremely eroded surfaces were classified as indeterminate. The bowl or jar distinction was often difficult to make because of the small sizes and eroded conditions of most sherds in the assemblage, but the indeterminate category was seldom used.

Both vessel form and size may provide functional information (Braun 1983; Nelson 1985). Assuming that bowls are generally used as serving implements and jars are more likely to be used for cooking or for liquid storage, vessel forms should provide some indication of the types of activities in the project area.

Similarly, the size of a vessel should be related to its use. Sherds in the current project area are greatly influenced by size differences in surface and subsurface deposits and exposure. However, measurements of sherd size are the only path to understanding vessel size because of the condition of the assemblage, and some relationship between the size of the vessel and the average sherd size produced when that vessel is broken is assumed. Although this relationship was influenced, and perhaps determined by a variety of factors, ceramic weight was used to examine patterns in sherd size—and by implication, vessel size—at the landform level within the project, as well as for comparisons between this project and other areas.

Types and Elements

Most of the more than 1,000 sherds are undifferentiated brownware, which dates between 250 and 1450 A.D.; 114 sherds are either El Paso Polychrome or El Paso Bichrome and date to the El Paso phase. The only intrusive ceramics recovered in the project area are eight sherds of Mimbres Black-on-white. Thirty-five brownware sherds from one area (FB12324) may be Protohistoric. Sixteen sherds, primarily undifferentiated brownware, show evidence of modification.

Twenty rim sherds collected from the project area include fourteen El Paso Brown (70 percent),

five El Paso Polychrome and Bichrome, and one Mimbres Black-on-white. Thus, 75 percent of the rim sherds date to the Mesilla phase. This pattern of relatively greater use of the project area during the Mesilla phase is similar to that suggested by the obsidian and radiocarbon dates from the project.

Table 7.1 lists data on rim sherds, including type, site location, and rim sherd index (RSI) values. RSI data calculations for project sherds using the procedure outlined by West (1982) are provided for future comparisons, but are not used in this report because of the small assemblage size. Estimates of vessel orifice diameter, derived using a spherometer following procedures outlined by Plog (1985), are provided for sherds of sufficient size.

Table 7.1. Rim Sherd Attributes.

FB Site No.	Ceramic Type	RSI Value	Orifice Diameter (cm)
6741 (41EP1028)	El Paso Brown	0.82	N/A
	Mimbres	1.52	40.20
	El Paso Brown	1.09	N/A
10411	El Paso Bichrome	0.85	17.90
	El Paso Bichrome	1.06	N/A
	El Paso Bichrome	1.28	24.80
	El Paso Polychrome	1.25	N/A
	El Paso Polychrome	1.24	N/A
10416	El Paso Brown	N/A	N/A
10417	El Paso Brown	0.71	N/A
	El Paso Brown	0.62	N/A
	El Paso Brown	0.61	17.80
	El Paso Brown	0.75	43.70
	El Paso Brown	N/A	N/A
11299	El Paso Brown	0.96	N/A
12102 (41EP4908)	El Paso Brown	N/A	N/A
	El Paso Brown	1.08	N/A
	El Paso Brown	N/A	N/A
12248	El Paso Brown	0.75	N/A
12330	El Paso Brown	N/A	N/A

Vessel Form

Vessel form classification is tenuous at best because of the size and condition of the assemblage. Variations in sherd condition and finish exist, and most sherds have some erosion damage on the surface; sometimes the original surface has been destroyed. Sherds retaining their original surface have a range of finishing techniques, from deeply grooved interiors to well-smoothed surfaces.

Analysis results suggest that jars are the most common form represented at the project level. They account for 75 percent of all sherds and 84 percent of sherds that could be assigned to either the bowl or jar group. Bowl sherds make up 15 percent of the overall assemblage, with the remaining 10 percent assigned to the indeterminate class. Sherds in the latter class tend to be extremely small and eroded. There are no major differences in the ratio of bowl to jar sherds by ceramic type. Just more than 16 percent of all El Paso Brown and undifferentiated brownware sherds and 17 percent of El Paso Polychrome and Bichrome sherds are classified as bowls.

The dominance of jar sherds in the assemblage was expected. Jars had rough interior surfaces and, because much of the assemblage is eroded, it was expected that this class would be overrepresented in the collection. Also, jars were often much larger than bowls, and therefore should have produced more sherds when broken. Although rim sherd data would clarify the true ratio of bowl to jar sherds, the small number of rim sherds precluded such an analysis.

Bowl sherds were more common in highly eroded areas (16.9 percent of identifiable sherds) than in unexposed areas (14.6 percent). This pattern was contrary to expectations; bowl sherds should be increasingly unlikely to be identified in eroded areas. In addition, 20 percent of the surface sherds are from bowls, whereas only 8 percent of the excavated sherds are in this class. As with the exposure classification, bowl sherds were expected to be less identifiable on the surface because they should have been subjected to greater degrees of weathering, and, therefore, they were expected to more likely be classified as jar sherds. Because neither of these expectations was borne out in the distributions, the identification criterion of bowl versus jar sherds may not be influenced significantly by exposure.

Of those sherds that could be placed in either the bowl or jar group, the percentages vary according to the three major topographic areas of the project. Sites associated with the playa ridge had the highest percentages of bowls, with more than 25 percent. The northern area had the highest percentage of jars (87.5 percent). Sherds in the southern region away from the playa had similar percentages, with just more than 85 percent being jars. Michalik and Batcho (1988) report a similar ratio of jar-to-bowl sherds on four small sites in the central basin where jar sherds range from 74 to 100 percent, with three sites having more than 90 percent jar sherds.

The percentage of bowl sherds in an assemblage seems to be somewhat greater on large sites with substantial structures along the margins of the bolson. For example, Scarborough (1986) reports that bowls comprise 48 percent of the 52 rim sherds from Meyer Pithouse Village. Similarly, Miller (1989) reports that bowls make up 39 percent of the rim sherds at the Gobenador Site, which had several substantial pithouses. However, when body sherds are considered, Miller's data suggest that bowls make up only 19 percent of the assemblage.

The higher percentages of body sherds assigned to the jar class are probably the result of the larger overall sizes and relatively small orifice diameters of jars, resulting in proportionately fewer jar rim sherds. The high percentage of jar sherds identified in the Project 90-11 area may be a result of the project's focus on body sherds. It also may be that jar forms are more common on basin sites than in assemblages associated with larger sites on the fans. Reid (1982) notes that sites in Arizona with more diverse assemblages tend to have a higher percentage of bowls, and sites with lower assemblage diversity seem to be dominated by jars. The pattern on Project 90-11 may reflect a more limited assemblage and by extension a more limited range of activities. However, without a more extensive assemblage, especially greater numbers of rim sherds, the identified pattern of higher jar percentages in the basin must remain tenuous.

Sherd and Vessel Sizes

Only five sherds have sufficient interior rim curvatures to make measurements of orifice diameter possible (see Table 7.1). The largest calculated diameter (43.7 centimeters) is a brownware rim from FB10417. A classic Mimbres rim sherd from the surface of FB7547 (41EP964) has an estimated orifice diameter of 40.2 centimeters. One other brownware rim from FB10417 had an orifice diameter of 17.8 centimeters. The remaining two sherds were El Paso Bichrome rims that measured 17.9 and 24.8 centimeters. Given the limited number of rim sherds, there is little analytical potential for this variable within the project, though these data may prove useful in comparison with future projects in the area.

Patterns of size and weight variation on the project are extremely difficult to interpret because of sherd size differences in surface and subsurface assemblages, the generally exposed and impacted nature of the project area, and the limited understanding of ceramic size variation compared with vessel sizes. For example, the average sherd weight in exposed areas is 3.71 grams with a median weight of 2.2 grams; in built-up areas the average weight is 5.04 grams and median weight is 2.7 grams. The smaller overall sherd weights in exposed areas suggest that exposure influences this variable.

Finally, if the significant effects of exposure and vehicular traffic on sherd size are ignored, the rela-

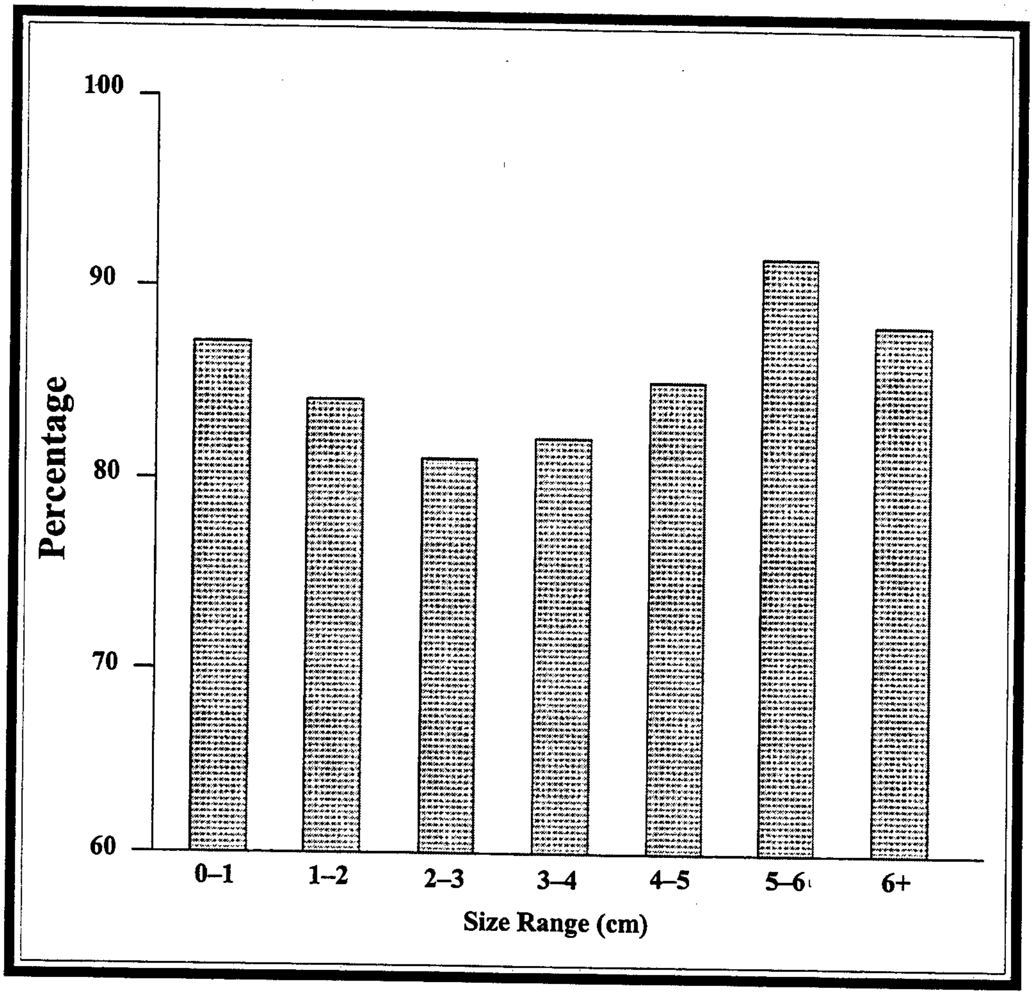

Figure 7.1. Jar Sherd Sizes.

tionship between vessel size and sherd size is not understood. Support for some form of relationship comes from consideration of the average weight of bowls and jars in the project area. Bowl sherds have an average sherd weight of 3.9 grams (median weight 2.2 grams) and a maximum weight of just more than 40 grams. Jar sherds, in contrast, have an average weight of 4.5 grams (median weight 2.6 grams) and the largest jar sherd is more than 100 grams. Jar fragments are more common in the smallest size class, and become more frequent in size ranges greater than 4 centimeters (Figure 7.1). This is a pattern that would result from the breakage of larger vessels.

There is some evidence that sherd size is related to vessel size, but there is also considerable evidence that within the project area sherd size is greatly influenced by postdepositional processes. The sherd size data become interesting, however, when weight is compared with ceramic types. All undifferentiated brownware and El Paso Brown sherds combined into one class produce an average weight of 4.13 grams (median 2.3 grams). The 114 sherds of El Paso Polychrome and Bichrome, however, have a mean weight of 2.45 grams (median 1.93 grams). El Paso Polychrome sherds, on average, are much smaller than the types that were more common during the Mesilla phase. Both data sets had a similar ratio of bowls to jars. The difference may indicate that smaller vessels were used during the El Paso phase, a pattern that is considerably different from that seen at a regional level where El Paso phase assemblages often include extremely large jars. The pattern, however, may also be a consequence of where design elements occur on El Paso Polychrome vessels. Designs often occur on the upper parts of vessels in thinner areas that may be subject to more substantial breakage.

SUMMARY

Analysis of 1,017 ceramic sherds collected on sites in the project area was limited by the low number recovered, the low number of rim sherds, the overall small size of the sherds, and their eroded condition. Nevertheless, analysis suggests that El Paso Brown and related types dominate the small rim sherd assemblage, indicating greater use of the region in the Mesilla phase than in the El Paso phase. Jar sherds are by far the most common form, accounting for a high proportion (84 percent) of body sherds that could be classified as either bowls or jars. This pattern contrasts with larger sites along the fans where jars and bowls seem to be more evenly represented. In the project area, bowl sherds seem to be more frequent along the playa ridge where they account for 25 percent of the identifiable assemblage.

Finally, although several variables affect sherd size, thus making it difficult to interpret, the El Paso Polychrome assemblage may be the result of smaller vessels than were in use during the Mesilla phase. This pattern, if real, does not seem characteristic of the region overall where large El Paso Polychrome jars are common in some assemblages.

Chapter 8

LITHICS

Chipped stone (N = 6,748) and ground stone (N = 1,933) are the major artifact categories collected from sites on the project. In addition, 80 chipped stone and 28 ground stone specimens were collected from nonsite areas. A variety of analytical techniques were employed to examine variability in lithic assemblages. Results of the lithic analyses primarily have implications for understanding the functional context of the project area, though several researchers (Carmichael 1986; Laumbach 1980) argue that they also may prove useful for understanding adaptive contexts and the temporal placement of assemblages.

Raw Materials

A critical part of the lithic analyses was the geological survey of available materials in gravel deposits in the project area. Results of the survey identified a wide variety of potentially usable stone tool materials. Using the data as a baseline, patterns of raw material use, tool and material relationships, and reduction patterns were examined. Within the tool category itself a low level use-wear analysis was conducted, and edge angle attributes and overall tool size were studied.

Raw materials affect all aspects of lithic reduction (Goodman 1944; Kelly 1985; Nelson 1981). Initial shape, size, and condition of raw material should affect cortex percentage, flake breakage pattern, the type of tool produced, and the ability of the analyst to distinguish attributes such as flake orientation and platform preparation. Raw materials differ in suitability for performing different tasks. Coarse-grained materials produce edges that are durable, but dull, whereas edges on fine-grained materials are sharp, yet brittle (Kelly 1985; Nelson 1981). Because such qualities are important for different tasks, selection of raw materials that incorporate appropriate qualities can be expected (Ranere 1975).

Results of lithic analyses suggest a strong relationship between raw material characteristics and use. High quality, cryptocrystalline materials, which tend to occur in smaller size ranges, were frequently used for production of formal tools such as unifaces, bifaces, and projectile points. Conversely, coarse-grained materials were frequently employed for ground stone and hammerstones and may have been associated with activities that required stronger, more durable tools.

Differences in the uses of higher quality raw materials may reflect temporal and adaptive differences. Highly mobile groups may use raw materials from distant locations; less mobile groups may use local materials (Goodyear 1979). Carmichael (1986), Thompson and Beckett (1979), and Whalen (1980) suggest that the use of fine-grained versus coarse-grained material changed through time. Patterns revealed by Project 90-11 analyses suggest that any attempt to relate specific raw materials to specific sources as an indication of mobility—let alone any use of these data as a temporal indicator—is complex.

The nature of raw material acquisition in the project area appears to vary according to availability, scavenging, and perhaps the tool type itself. Various combinations of size and cortex patterns in debitage and cores suggest that obsidian, chalcedony, and a high percentage of cherts—with the exception of Rancheria—from the archaeological assemblage, may have been obtained from gravels within the project area. In addition, many of the remaining materials resulting from chipped stone production probably represent recycling or reuse of ground stone rather than a primary acquisition strategy.

The distinction between formal (retouched) and informal (utilized flakes and debitage) tools suggests that differing acquisition strategies may have been involved within certain raw material types. Informal tools of obsidian, chalcedony, and all cherts may have been locally acquired, but the formal tools of chalcedony and chert may have been brought into the project area.

Archaeological data from this project in combination with data from other projects suggest that simple availability may be a major factor in the specific materials identified. However, there may be patterns in more generic raw material attributes such as the use of fine-grained relative to coarse-grained material.

In addition to providing information on raw material sizes, cortex percentages were used to monitor reduction. Several studies (for example, Magne 1985; Tomka and Mauldin 1984) suggest a general relationship between the point in the reduction process and cortex cover. Cortex percentages also may be related to the type of reduction. In bifacial work, the cortex may be removed early in the sequence, whereas core reduction may be reflected by a higher incidence of cortex. Because strong relationships exist between material and the types of tools produced of that material, the data suggest that cortex patterns are a result of both raw material size and reduction. Cortex patterns in both tool types and debitage suggest that high quality materials such as obsidian and cherts tend to have a higher incidence of reduction into formal tools.

Edge angle and edge damage patterns also suggest weak relationships to raw material characteristics, especially with edge damage. A comparison of edge damage patterns with blood residue analysis hints at a relationship between cryptocrystalline material use and animal processing.

The quality, quantity, size range, form, and availability of materials may determine the patterns seen in lithic use. Project 90-11 focused on the availability of various materials within the project area, the pattern of raw materials used for various specimens in the project lithic assemblage, and the quality of those materials. The results suggest that (1) although most raw materials used in the lithic assemblage were transported into the project area, a significant component of the assemblage may have come from local gravels, (2) availability may have been an overriding factor in the use of specific raw materials, and (3) materials were selected to perform different tasks based on characteristics of internal consistency, composition, and size.

Material Classification

Raw materials for all lithics on the project were initially classified into 21 categories. As analysis began, it was clear that many categories had such small sample sizes that they were analytically useless. The original 21 were combined into 10 classes believed to reflect the quality and suitability of the material for a variety of tasks and preserve enough distinctive information to assess availability throughout the region. Raw materials were classified by relative internal consistency into four divisions ranging from very coarse to very fine. These variables, designed to measure the predictability of material during flake production, were subjective determinations.

The predictability with which a flake can be removed should have implications for the interpretation of flake breakage patterns and for the uses of the material. For example, a study by Foster et al. (1982) shows that Thunderbird (Franklin) rhyolite is an extremely hard material that produces a dull but durable edge. It is unlikely that this material would have been used extensively for the production of bifacial tools because its many inclusions make it extremely difficult to control flake removal.

Geological Survey

A geological survey conducted within the project area evaluated the availability of raw materials. The specific goals of the survey were to identify the relative frequencies of available raw material classes and to provide information on size ranges of those raw materials. This information is relevant to answering questions about mobility, as well as selection of specific material types in the project area for specific tasks.

The survey procedure was a modification of the standard Fort Bliss archaeological survey. The project area, a 1-by-5-kilometer block encompassing the southern and northern areas and cutting through much of the central area, was bisected by three transects. Spacing among three crew members was nominally 30 meters. Transect 1 was on the west side of the 1-by-5-kilometer block, Transect 2 was in the middle of the project area, and Transect 3 was on the eastern edge. Each transect was divided into 100-meter-long transect recording units (TRUs). Crew members recorded all gravels in the 2.5 meters on either side of their transect line, thus providing about a 4.5 percent sample of the 5-square-kilometer area.

Although such wide transect spacing provided little information on archaeological materials, the underlying structure of the population of artifacts across space is quite different from that of lithic materials. Mauldin (1992) shows that transect data are probably representative of the relative frequency of raw materials available in the project area. There is little variability in comparisons of the transect and TRU totals.

Recording procedures conducted at the TRU level by each recorder provided information on the size of gravels and the number of given raw material

types in that size. Twenty-one raw material types were combined into 10 categories comparable to the 10 lithic artifact material classes. Gravels were recorded by material type and divided into four size categories; 0–3.0 centimeters, 3.1–6.0 centimeters, 6.1–9.0 centimeters, and 9+ centimeters. The number of nodules of a given material that fell into a size class were recorded at ordinal levels of 1–5, 6–10, 11–15, and so on, with increasingly wide intervals at higher numbers.

A total of 20,429 items was observed in 150 TRUs across the 5-square-kilometer area. The sample sizes are large and the patterns in raw material frequency and size are strong. In size, 82 percent of the nodules are smaller than 3 centimeters in maximum length. Almost 17 percent are 3.1 to 6.0 centimeters and just more than 1 percent are greater than 6.0 centimeters. The vast majority of gravels, both overall and within a given material type, are smaller than 3.0 centimeters in maximum size, including obsidian (98 percent), miscellaneous chert (95 percent), chalcedony (92 percent), quartzite (87.5 percent), and basalt (85.5 percent). Only 67 percent of Franklin rhyolites are smaller than 3.0 centimeters.

Organ rhyolite makes up nearly 50 percent of the 20,429 items observed (Table 8.1). Miscellaneous chert, quartzite, and miscellaneous granular categories are also well represented. Chalcedony, basalt, Rancheria chert, obsidian, Franklin rhyolite, and silicified limestone are not available at high rates in the project area. Note, however, that though the relative frequencies of these materials are extremely low, almost 150 pieces of obsidian and over 150 pieces of Rancheria chert were observed in the sample. These materials are available in quantity, but are not common compared to other materials.

Table 8.1. Raw Material Availability in Project Area.

Material	#	%
Basalt	593	2.9
Chalcedony	645	3.2
Franklin rhyolite	45	0.2
Miscellaneous chert	2,974	14.6
Miscellaneous granular	3,204	15.7
Obsidian	144	0.7
Organ rhyolite	10,190	49.9
Quartzite	2,464	12.1
Rancheria chert	167	0.8
Silicified limestone/sandstone	3	0.0
Total	20,429	100.1

Examination of relationships between intra-project variability and erosion suggests that high counts are, not surprisingly, associated with high levels of erosion that are exposing the underlying gravels. The erosional history of the project area is unknown, but the relative percentages of material types and sizes are consistent across the study area, so that any given exposed area should have similar relative frequencies and similar size ranges. These data provide a measure of the raw material availability and size that would have been available to prehistoric inhabitants.

Usage

Figure 8.1 illustrates the distribution of all raw materials used in the production of chipped stone and ground stone items on the project. It does not include fire-cracked rock or materials used in features unless they have a ground surface, in which case they are classified as ground stone. There is little relationship between the percentages of a given raw material in the project area and the use of that material for artifacts in the lithic assemblage. Only the percentages of chalcedony, miscellaneous coarse-grained materials, and miscellaneous chert are similar. It does not appear that locally available gravels were used in proportion to their natural availability. This suggestion is strengthened by the relatively small size of the majority of gravels, which are certainly unsuited for most ground stone items. However, local gravels may have contributed to some component of the raw materials used in the project area. It is conceivable that the gravels observed on the project have been skewed by the removal of larger specimens and are not representative of past size ranges. However, it is unlikely that gravels in size ranges greater than 5 to 6 centimeters were ever very common at this location in the central basin. The majority of raw materials appear to have been brought into the project area, though they may have been initially acquired and used for a different tool type (for example, ground stone) than the tool or debitage type recorded as the final use.

There is a strong association between cryptocrystalline materials that are thought to occur in smaller sizes and the production of chipped stone items. Larger, grainy materials are used for both chipped stone and ground stone (Table 8.2). The differential use of raw materials is further highlighted when patterns of raw material use are contrasted with artifact type. For example, Franklin rhyolite, which makes up 8.5 percent of the materials in the chipped

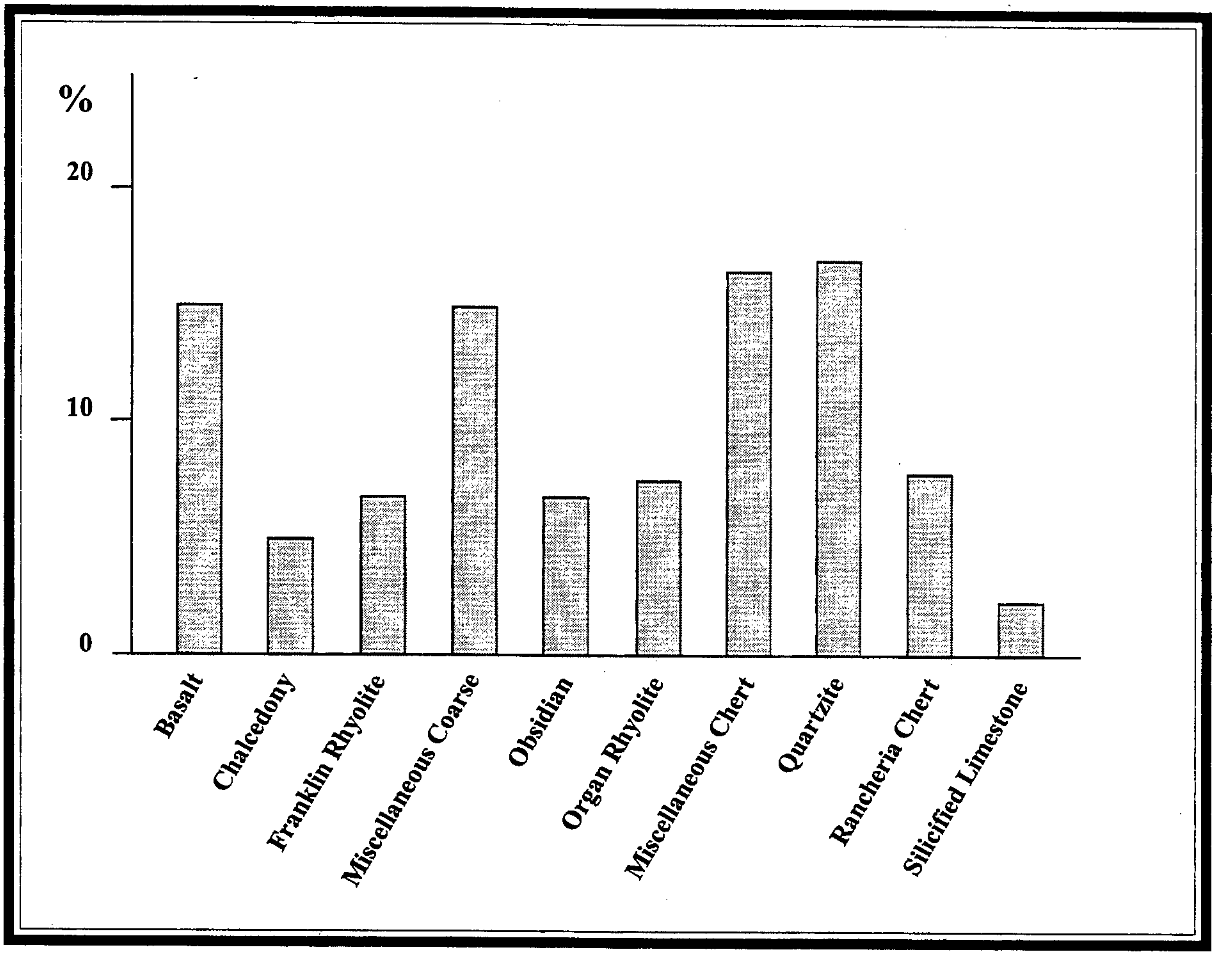

Figure 8.1. Raw Material Used in Chipped and Ground Stone.

stone class, accounts for over 40 percent of all hammerstones. This rhyolite is extremely dense and durable, which makes it well suited for hammerstone use. Cryptocrystalline materials make up 46 percent of the chipped stone material, but account for 64 percent of all formal tools and 87 percent of all bifacial tools on the project. These materials should produce more consistent flake removal patterns and sharper edges. Their use for formal tools and implements that require extensive work is consistent with the material structure.

A strong relationship also exists between artifact types and material quality attributes. Materials classified as very fine or fine consistency make up 53 percent of those used for the production of chipped stone. Yet, the class accounts for 72 percent of all formal tools, with less than 0.5 percent of the formal tools made of very coarse materials. Finally, there is a strong relationship between material used for

Table 8.2. Raw Material Use in Project Area.

Material	Chipped Stone		Ground Stone	
	#	%	#	%
Basalt	793	11.8	501	25.9
Chalcedony	419	6.2	0	0.0
Franklin rhyolite	571	8.5	55	2.8
Miscellaneous chert	1,430	21.2	0	0.0
Miscellaneous granular	691	10.2	614	31.8
Obsidian	579	8.6	0	0
Organ rhyolite	634	9.4	26	1.3
Quartzite	741	11.0	731	37.8
Rancheria chert	685	10.2	0	0.0
Silicified limestone/ sandstone	205	3.0	6	0.3
Total	6,748	100.1	1,933	99.9

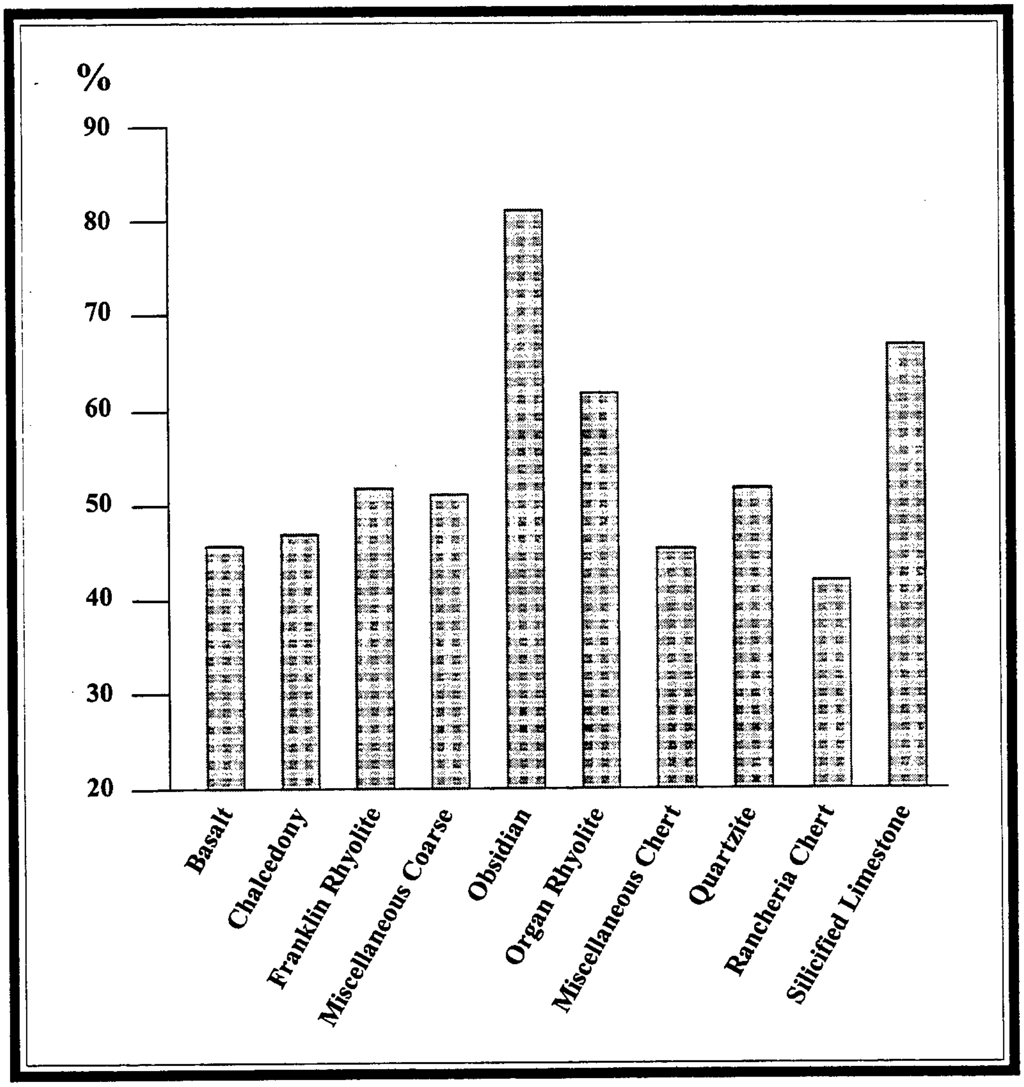

Figure 8.2. Chipped Stone Raw Materials with Cortex.

chipped stone and the presence of cortex (Figure 8.2). Cortex on a specimen probably is related to the degree and type of reduction, the use history of the item, and the initial size and form of the raw material.

Obsidian, a high quality cryptocrystalline material, was frequently used for formal tools and therefore extensively reduced, yet the vast majority of obsidian items still have cortex. The high frequency of cortex (Figure 8.2) is explained by the small sizes of the nodules used in reduction and their frequent recovery as cores in the project. The small nodules have a high ratio of cortex compared to the amount of noncortex interior area and it would be difficult to produce a flake from obsidian without some cortex present. At the other extreme, less than 50 percent of the basalt, which is a tough, relatively grainy material, has cortex. Basalt is rarely used for formal tools, and no bifacial tools made from this material were discovered; it does not seem to be extensively reduced. Many basalt items in the chipped stone class were previously used as ground stone. The relatively low percentage probably is related to initial decortication of ground stone, and the cortex percentages do not accurately reflect the intensity of reduction.

Raw material characteristics affect other aspects of a chipped stone assemblage. This effect relates not only to the presence of cortex on an item and the types of artifacts for which the material is suited, but also to a variety of additional variables including flake breakage and the ability of an analyst to distin-

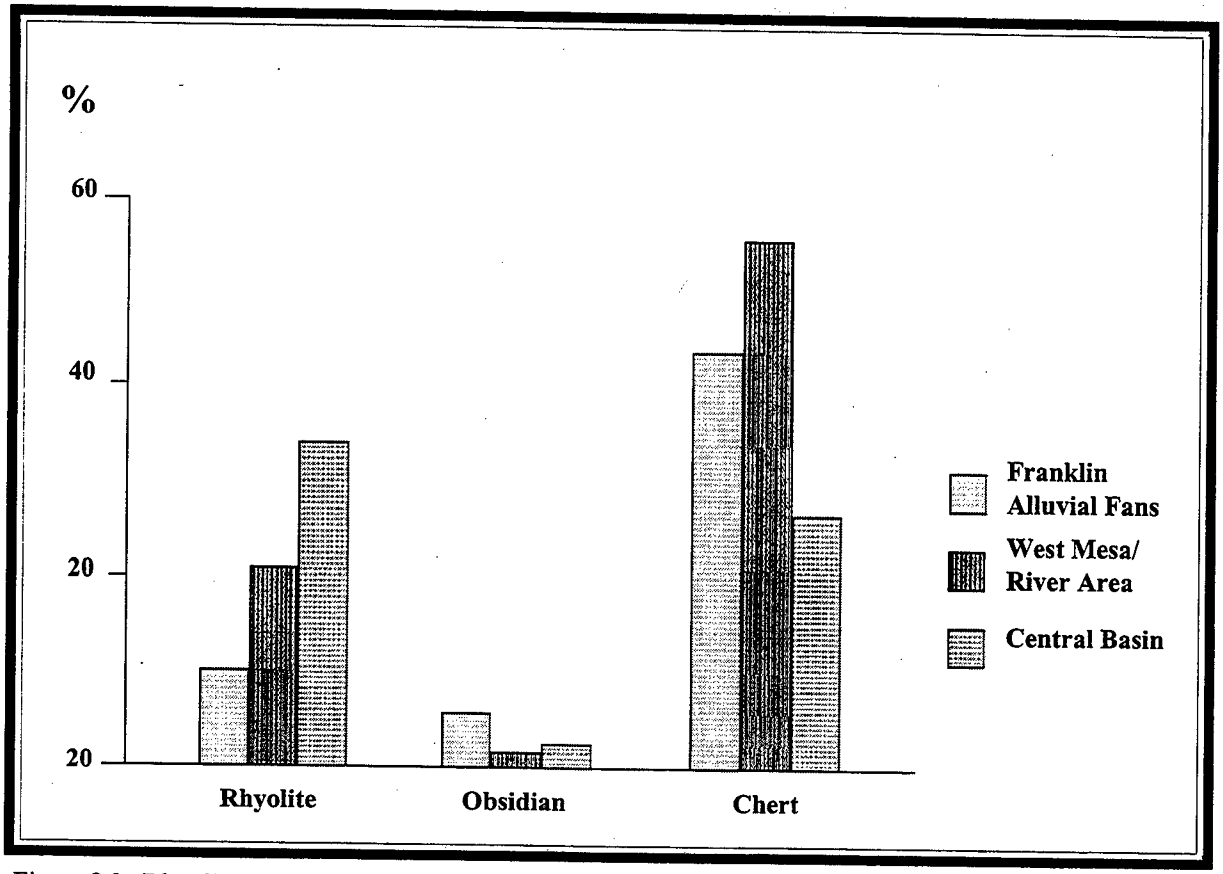

Figure 8.3. Rhyolite, Obsidian, and Chert in 16 Archaeological Projects in Central Jornada Region Landforms.

guish characteristics such as platform type, flake type, and evidence of use. It is necessary, therefore, to take into account the raw material differences when comparing most aspects of assemblages.

Regional Comparisons

Although specific regional project-by-project analyses varied, comparisons were possible for several major material types. As a final exploration of raw material availability, and in an attempt to place the current project level patterns in perspective, raw material data were assembled from 16 regional projects. Five projects were in the central basin, five were along the alluvial fans of the Franklin Mountains, and six were along the Rio Grande and West Mesa areas of El Paso (Figure 8.3).

Some patterns are apparent at the landform level, with obsidian being slightly more frequent in the basin, rhyolite being much more frequent along the Franklin fans, and chert most common in the Rio Grande-West Mesa region. Data on the relative availability of obsidian are not available. The overall pattern suggests that availability may have been a critical element in determining specific patterns of raw material percentages at a location. These patterns complicate any simplistic use of specific material frequencies to identify changes in either mobility or temporal patterns.

Chipped Stone

A series of observations made on each piece of chipped stone, both debitage and tools, included type and quality of raw material, type of artifact (flake, core, etc.), cortex percentage, and size attributes. A primary reason for selecting these attributes was the project's focus on tool production and core reduction. Tool production is the manufacture of formal tools such as bifaces and projectile points that involves the

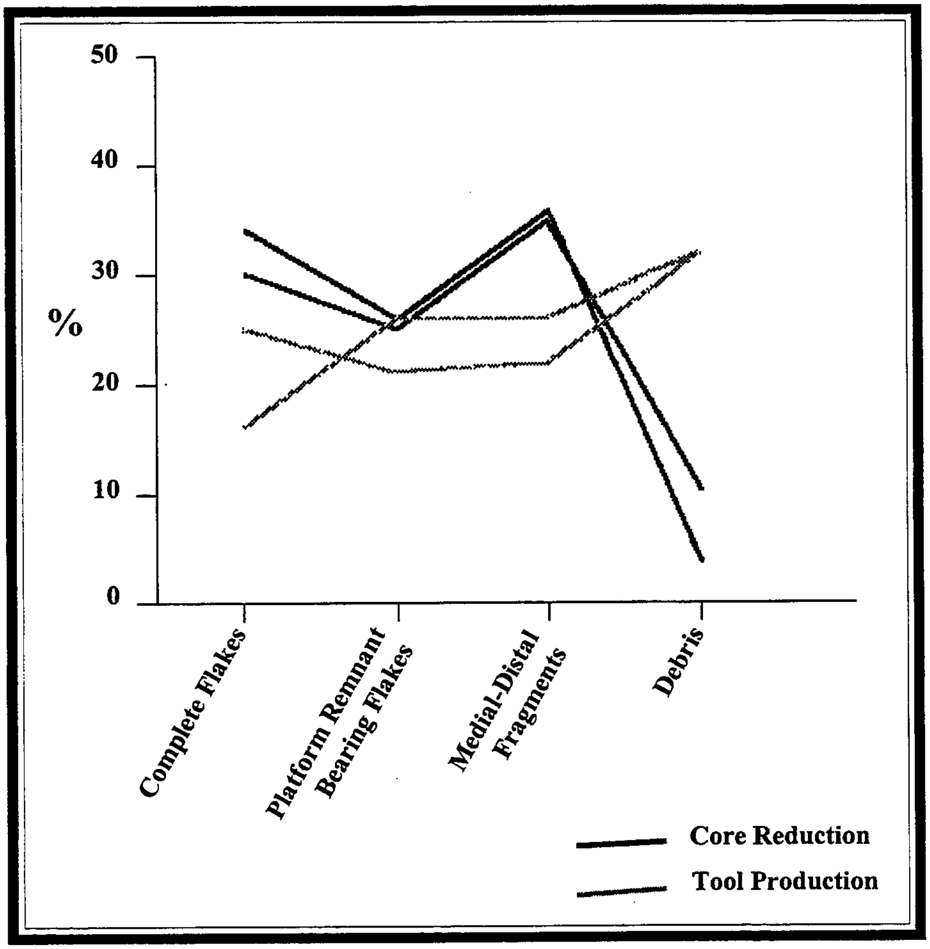

Figure 8.4. Experimental Flake Breakage Pattern Results.

reduction of flakes removed from cores. Core reduction, conversely, involves the removal of flakes for immediate use, such as flake tools, without significant subsequent reduction.

Artifact designations included flakes, cores, formal tools, informal tools, and hammerstones. Morphological attributes of formal and informal tools, including size, edge attributes, and wear patterns were examined. The rationale behind this focus is that a given task, or set of tasks, places constraints on tool morphology. A set of morphological attributes is assumed to provide an optimal solution to a task, with changes in that morphology resulting in reduced efficiency. Yet, the gains in efficiency that result from an optimal solution are properly seen against other factors such as the cost of tool production, quarrying activities, and tasks associated with the total activity (Jobson 1986).

Variations in tool morphology should provide a measure of the variety of activities conducted and some insights into specific kinds of activities. For example, experimental research shows that tool size is an important element in tool performance (Jobson 1986; Jones 1980). Larger tools are more easily manipulated, especially without hafting. In addition, edge angles affect performance in that certain angles are well suited for some activities and inappropriate for others. Certain wear patterns seem to result from certain broad sets of activities. For example, several studies suggest that polishing results from the use of a tool on soft materials such as hides and flesh, and rounding or scaring of the edge may result from working harder materials such as wood or bone (Keeley 1980; Tringham et al. 1974). When used in combination with the morphological variables, these data should provide information on the types of activities conducted.

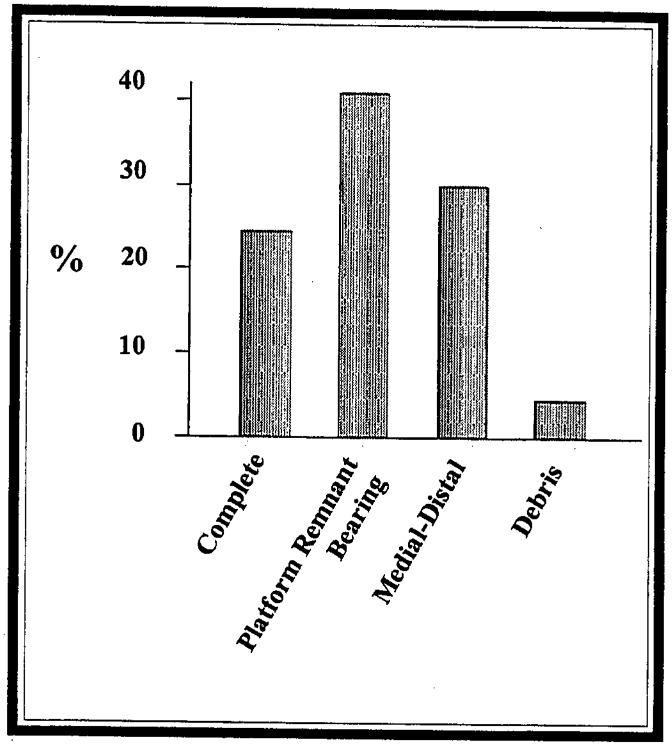

Figure 8.5. Flake Breakage Patterns, Project 90-11.

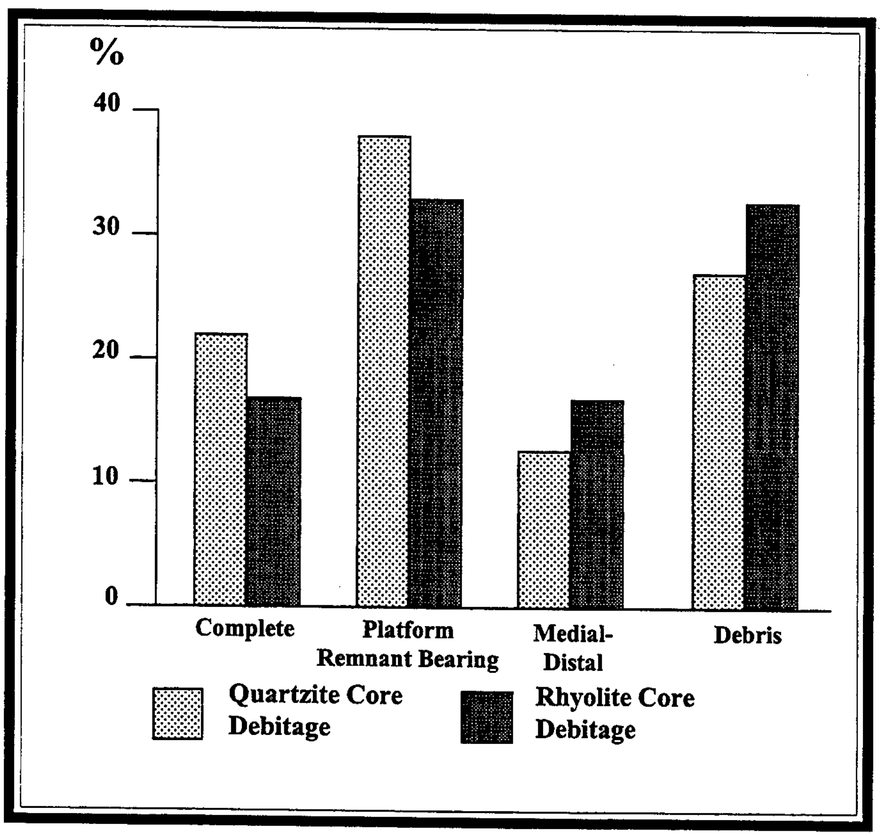

Figure 8.6. Experimental Core Reduction Using Local Materials.

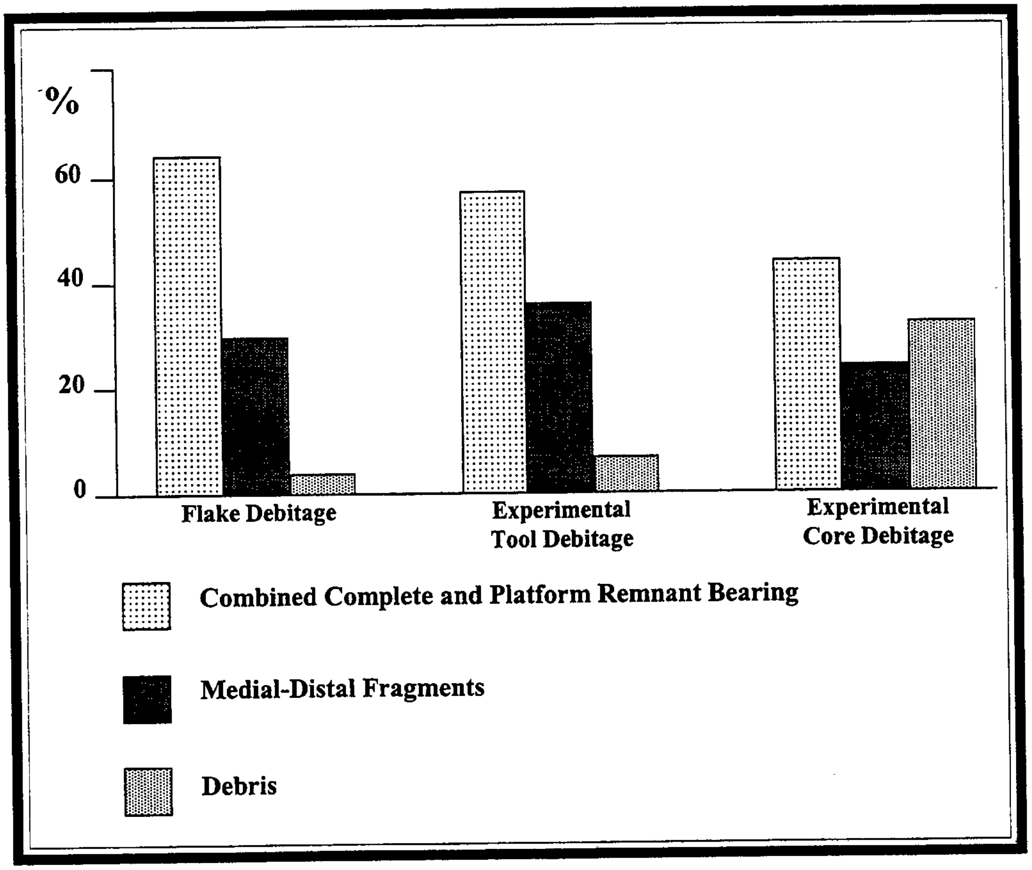

Figure 8.7. Reworked Data for Archaeological and Experimental Debitage.

Flakes

Types

Flake analysis involved identification of breakage patterns in assemblages. Flake types used in the project analysis are from Sullivan and Rozen's (1985) discussion of lithic reduction:

- Complete flakes: specimens with platform, feather termination, and intact margins
- Platform remnant bearing flakes: specimens with a platform but lacking a hinge or feather termination
- Medial-distal fragments: specimens that lack a platform but have an identifiable interior surface
- Debris: specimens with no identifiable interior surface

Sullivan and Rozen (1985) suggest that flake types reflect the extent of tool production and core reduction at a location. These expectations come from fracture mechanics. Briefly, they suggest that because tool production often involves the removal of thin flakes, more flake collapse will occur. This should result in fewer complete flakes, and more medial-distal and proximal flake fragments. Conversely, a high percentage of complete flakes and debris characterizes core reduction.

Experiments by Prentiss and Romanski (1989) involving tool production and resharpening, along with several involving core reduction, suggest different patterns of flake types produced (Figure 8.4). Complete flakes appear to be more commonly associated with tool production, as do high percentages of medial-distal flakes and low percentages of debris. Core reduction, conversely, has lower percentages of complete flakes, similar proportions of medial-distal and platform remnant bearing flakes, and higher percentages of debris.

Using this experimental data, Prentiss and Romanski (1989) performed trampling experiments on the assemblages in unconsolidated sand. The results suggest that, in general, trampling reduces the percentages of complete flakes and increases the

percentages of medial-distal fragments. It does not significantly affect the percentages of either debris or platform remnant bearing flakes.

The pattern of flake breakage types for the 5,912 flakes from Project 90-11 (Figure 8.5) is unlike either identified for core reduction or tool production. Especially troubling is the high rate of platform remnant bearing flakes compared to medial-distal flakes and debris. If a flake is broken, as platform remnant bearing flakes are, the broken section will end up in either the medial-distal category or the debris category. Although size sorting affects the project pattern, the subsurface assemblage still has a higher ratio of platform remnant bearing flakes to medial-distal fragments (39 percent versus 35 percent). The differences are consistent across material types. When the effects of trampling, which should increase the number of medial-distal fragments, are added the pattern makes even less sense. Several possibilities may account for this aberrant pattern.

First, the number of experimental assemblages is limited and they were conducted on large chert cobbles. It is unlikely that a substantial component of the Project 90-11 assemblage originated from large chert cobbles. The pattern identified in the project may be real, but the limited experimental data is inadequate to document it. To supplement these data, two core reduction experiments using local Franklin rhyolite and quartzite were conducted in an attempt to produce usable flakes rather than reduce either core to a tool. The results of both experiments (Figure 8.6) are different from the archaeological data and show some similarity to core reduction patterns identified in Figure 8.3. The high percentage of debris in both experiments is quite different from the assemblage patterns.

The second possibility is problems with the archaeological analysis. An unknown proportion of complete flakes may have been classified mistakenly as platform remnant bearing flakes, which would decrease the number of complete flakes and increase the percentage of platform remnant bearing flakes. The average maximum length of complete flakes is somewhat larger than platform remnant bearing flakes (mean = 1.93–1.83 centimeters), although the difference is slight and complete flakes have more items with cortex than platform remnant bearing flakes (59 percent versus 47.5 percent). Both the size and cortex data suggest differences between the two classes, and the pattern is one that makes intuitive sense. Complete flakes should be, on average, larger, and should have more cortex than platform remnant bearing flakes. Without reworking the original analysis, however, this discrepancy cannot be resolved.

If the number of complete flakes and platform remnant bearing flakes are combined, and the same is done for the comparative experimental data, the pattern is close to what would be expected for an assemblage dominated by tool production (Figure 8.7). The major similarities are in the relatively low percentages of debris and the moderate percentages of medial-distal fragments. When these patterns are compared across raw material types, all have similar patterns. For example, Franklin rhyolite, a material that tends to break along short fracture planes and is unlikely to have been used extensively for tool production, has a low percentage of debris and a moderate percentage of medial-distal fragments, which is characteristic of tool production.

The Project 90-11 archaeological assemblage may document a pattern dominated by tool use or a pattern not previously replicated in experimental research. It may also be that analysis of this particular variable was not consistent with the categories used in the experimental research. Flake types, although useful for comparing cortex and size parameters, cannot, at present, be tied to tool production or core reduction.

Cortex

Cortex percentage should have some general relationship to the degree of reduction, though the percentages must be considered relative to raw materials. The percentage of cortex on each item of debitage was estimated in three ordinal categories: flakes without cortex on the dorsal surface or platform, flakes with between 1 and 50 percent cortex on the dorsal surface or platform, and flakes with more than 50 percent cortex on the dorsal surface or platform. On debris where no internal surface could be identified cortex percentages were estimated on the entire piece. All estimates were subjective.

Cortex is commonly used as a measure of reduction, with decreased cortex signifying increased reduction. However, cortex percentage is greatly influenced by the size and form of the original piece (see Figure 8.2); for example, obsidian consistently has high cortex values, but this probably relates to the size of the piece rather than the lack of reduction. Generally, flakes with higher percentages of cortex

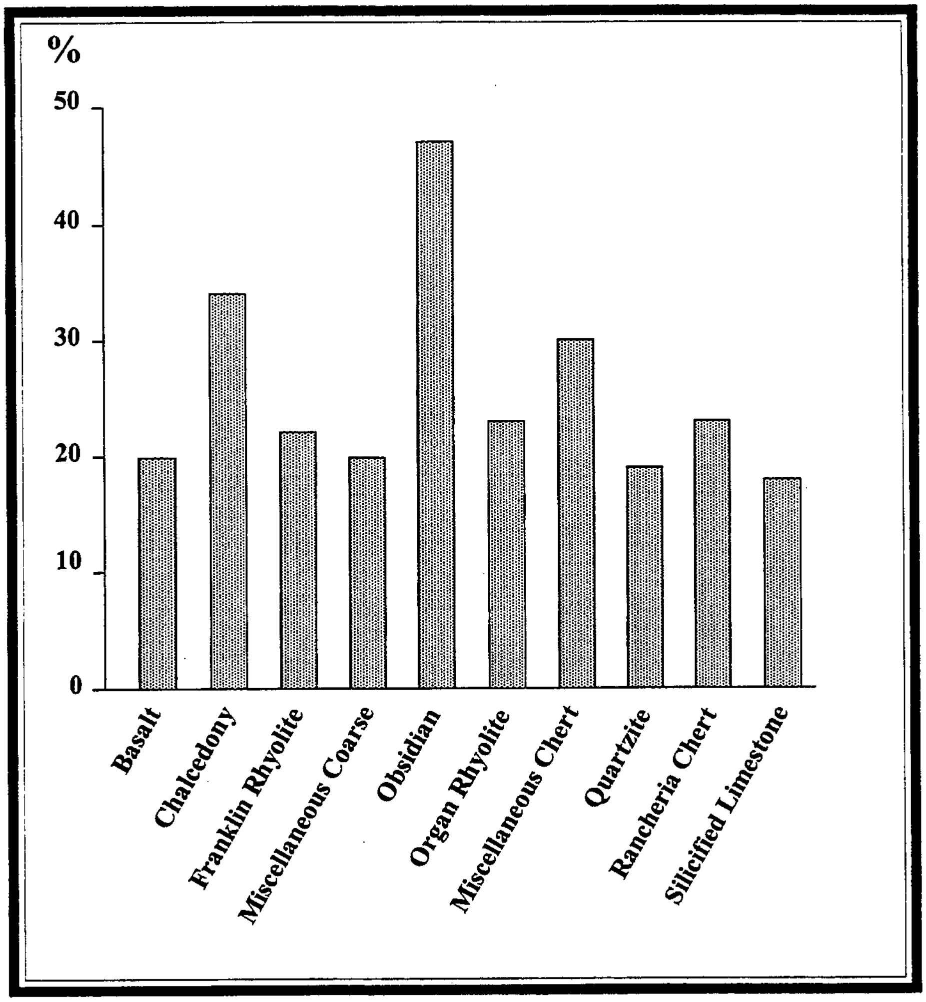

Figure 8.8. Raw Material, Multifaceted Platforms without Cortex.

are removed early in the reduction sequence and flakes with no cortex tend to be late. However, experimental research suggests that small flakes that lack cortex are not uncommon early in a sequence, and flakes with cortex can occur quite late (Amick et al. 1988; Mauldin and Amick 1989; Tomka 1989). When combined with raw material differences, direct comparison of cortex as a measure of reduction—especially between assemblages composed of different frequencies of raw materials—becomes difficult. However, if cortex data are used in combination with other measures, and material type is controlled, the variable is of considerable use.

Platforms

Two types of platforms were distinguished and monitored: single facet or cortex platforms and multifaceted, which includes ground or crushed platforms. The multifaceted platform category may be more characteristic of tool production. Tomka (1989) shows that grinding occurs more commonly on debitage associated with tool production than on debitage from core reduction. Grinding may be associated with increasing the strength of an edge, which would reduce the probability of platform crushing. Still, platform crushing may occur more often in cases of acute edges, such as in bifacial work. Core reduction involves more obtuse angles. The occurrence of faceting or grinding and crushing may,

Table 8.3. Flake Thickness by Type.

Breakage Pattern	Number	Mean	Median
Platform	3,865	0.51	0.40
Medial-distal fragment	1,788	0.46	0.33
Debris	259	1.10	0.95
Total	5,912		

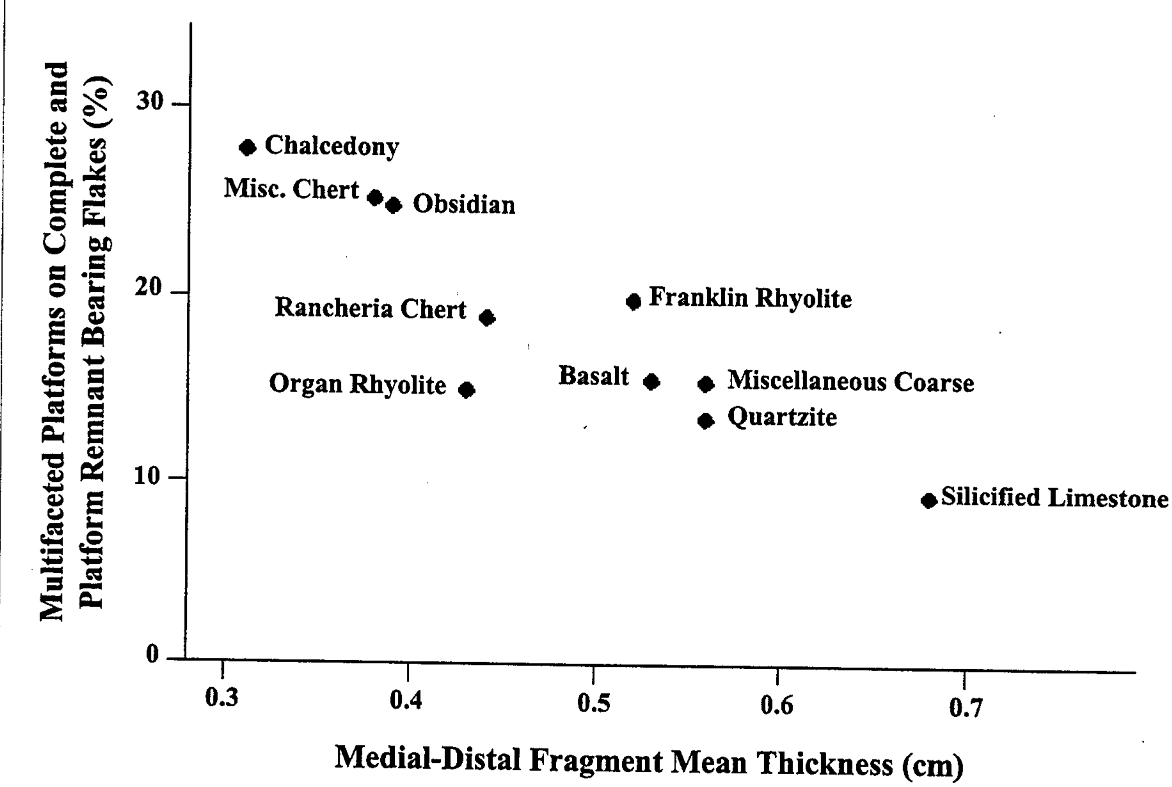

Figure 8.9. Material Relationships, Medial-Distal Fragments and Multifaceted Platforms.

therefore, be lower than in the production of formal tools, and cortex and/or single facet platforms should occur more frequently with core reduction.

Because multifaceted platforms should be more common in tool production and tool production should be characterized by late-stage reduction, there should be a positive relationship between the two variables that can provide clues about the use of raw materials. Obsidian, chalcedony, and miscellaneous chert have a high occurrence of multifaceted platforms, suggesting that these materials may have been used more often for formal tools, especially those involving retouch (Figure 8.8). Noncortical flakes in the remaining seven materials have fewer multifaceted platforms, suggesting that these materials were infrequently used in tool production.

With the exception of Rancheria chert and silicified limestone, the percentage, and, by implication, the use of these materials for tools seems to follow along material quality lines. Materials that have some indication of use for tools are cryptocrystalline in structure, whereas those that lack high percentages of multifaceted platforms, tend to be composed of coarser materials that produce a duller edge.

Size

Length and thickness were recorded on all flakes. Flake length is the maximum dimension perpendicular to the striking platform, direction of force, or the maximum measurement when the direction of force cannot be determined. Thickness is the maximum cross section measurement. Flake size, especially thickness, has several implications. Several researchers suggest that debitage produced late in a tool reduction strategy is characterized by thin flakes. Conversely, thicker flakes characterize early reduc-

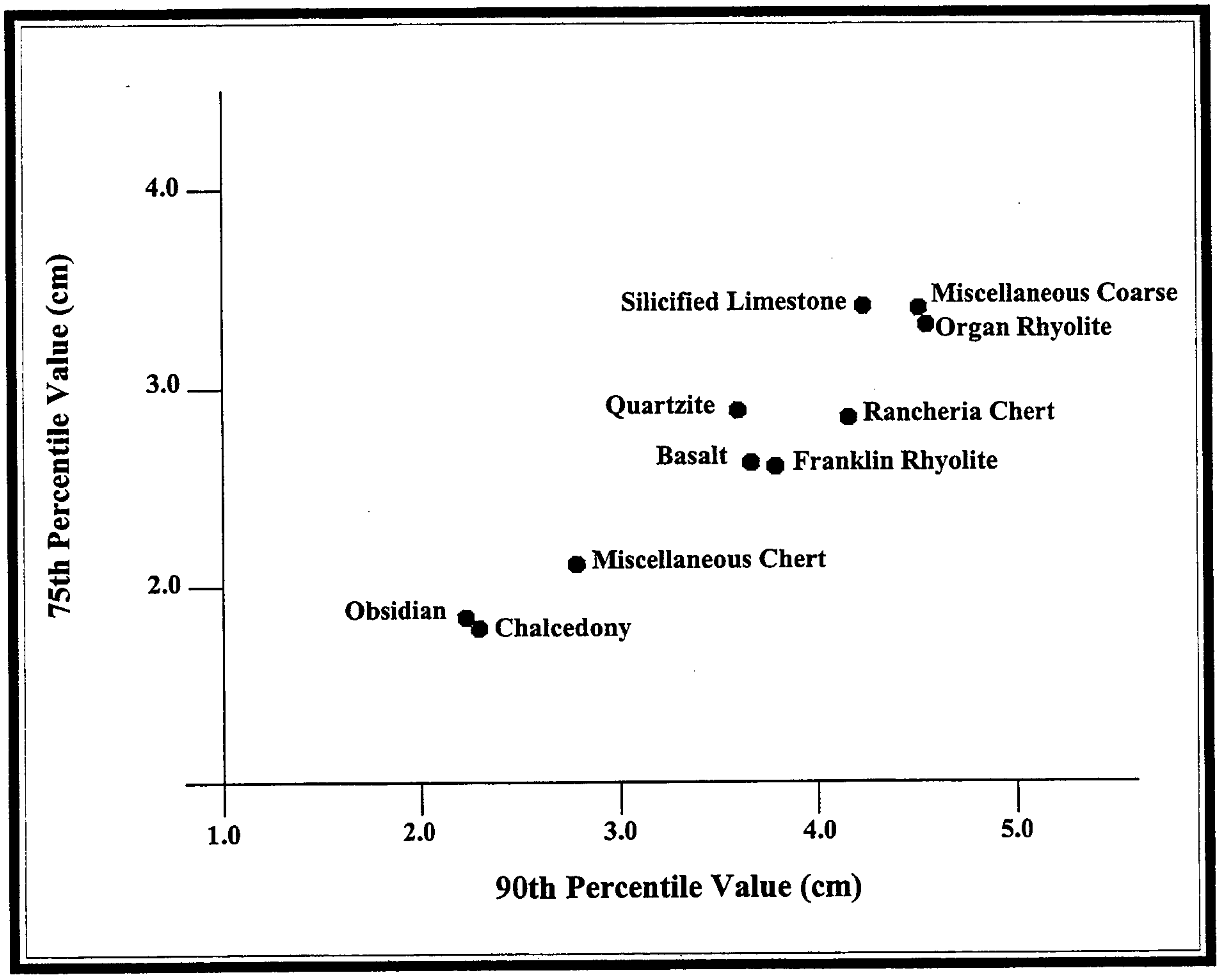

Figure 8.10. Complete Flake Lengths by Material.

tion activities (see Neumann and Johnson 1979; Stafford 1979).

In considering flake thickness, breakage patterns must be controlled. There is a strong relationship between flake types and mean thickness: medial-distal fragments are thinner than any other flake type, and debris is much thicker (Table 8.3). The relationship between flake types and tool and core production in the project assemblage is not understood; therefore, comparisons designed to isolate flake thickness as an independent measure must be made by flake type.

Multifaceted platforms should have a higher frequency in tool production. Similarly, medial-distal flake fragments should be, on average, thinner if they represent tool production rather than core reduction. Chalcedony, miscellaneous chert, and obsidian have thin medial-distal fragments and more multifaceted platforms, a pattern of tool production (Figure 8.9). A second group of materials is primarily coarse-grained, with the exception of Rancheria chert, and probably represents both core and tool production. Finally, silicified limestone forms a third group with fewer multifaceted platforms and thick medial-distal fragments. This group may represent a focus on core reduction with little or no tool production.

Flake length varies with material type. Figure 8.10 compares the value of the 75th percentile and the value for the 90th percentile by material type for the 1,452 complete flakes on the project. With the exception of debris, which makes up only 4 percent of the flake assemblage, complete flakes are the largest type. The use of percentiles, rather than the mean as a comparative statistic, is an attempt to gain some understanding of the upper size ranges in the distribution of a given material. The mean value can

be significantly influenced by extremely small and extremely large values, whereas percentiles are not influenced by a few extreme cases. The 75th percentile identifies the point at which 75 percent of the samples are below that value and 25 percent are above; the 90th percentile identifies the break point for 90 percent of the distribution. The focus on the upper size range is related to the raw material survey data. Most raw materials identified on the survey have a maximum size of less than centimeters, therefore materials larger than this value probably reflect imports into the study area.

Two distinct size groups are indicated (Figure 8.10). Percentile figures for obsidian, chalcedony, and the miscellaneous chert class suggest that over 75 percent of the complete flakes are less than 2.1 centimeters, and over 90 percent are less than 2.8 centimeters. Although the size distribution may be related to increased levels of reduction, the fact that such a large percentage is below the 3-centimeter threshold is consistent with the use of local gravels. The second flake size group consists of the remaining seven materials. Some of these flakes, especially quartzite, basalt, Rancheria chert, and Franklin rhyolite, are within the upper size ranges of the gravels, but the overall size ranges are more likely to be from nongravel sources.

As a final exploration of the possible relationship between raw material size, flake size, and acquisition patterns, the size ranges of all complete flakes with any cortex were examined for each material group. By eliminating complete flakes that lack cortex, the effects of more extensive reduction, which in general should produce smaller flakes with no cortex, are lessened. Each size distribution, especially those beyond the 3-centimeter maximum size for most local gravels, was examined for multiple size modes. Three material types have distinct size modes. The Organ rhyolite complete flake distribution has three size modes: 1 centimeter, 2 to 3.5 centimeters, and 4.5 to 5 centimeters. Franklin rhyolite complete flakes have two distinct modes, both under 3 centimeters. Finally, the miscellaneous coarse-grained material has two modes, one at 2 centimeters and one at 4 centimeters. Given the raw material size and quantity distributions, it is possible the Organ rhyolites in the study area and possibly some of the miscellaneous coarse-grained material class are composed of both local and regional material acquisitions.

Discussion

Results of debitage analysis for the project are both disappointing and encouraging. Patterns in flake breakage were essentially uninterpretable, primarily because of the high occurrence of platform remnant bearing flakes. Whether this pattern reflects a lithic reduction sequence that has not been replicated experimentally or a failure to apply the same debitage breakage classes used in experimental research consistently is unclear. However, patterns in relationships between cortex, thickness, and platform attributes seem to identify variables that distinguish between tool and core work.

A comparison of Figures 8.8 and 8.9 suggests that chalcedony, miscellaneous chert, and obsidian are materials frequently associated with tool production. The remaining materials probably represent both tool and core reduction, with a focus on cores. These observations are consistent with both the material quality estimates and the understanding of the materials as such. Obsidian, chalcedony, and the miscellaneous chert material class are cryptocrystalline in structure and produce a sharp, brittle edge. Most of the remaining materials are more coarse grained and produce edges that are dull but durable. The surprise is the lack of tool indications for Rancheria chert, silicified limestone, and to a lesser extent, Organ rhyolite. It appears, based on the results of debitage analysis, that these materials were primarily associated with core reduction.

Length measurements on complete flakes suggest that much of the obsidian, chalcedony, and miscellaneous chert material could have been procured from the local gravels. A significant portion of the larger size ranges of complete flakes are smaller than most local gravels observed on the raw material survey. Conversely, some of the silicified limestone, miscellaneous coarse material, and Organ rhyolite groups probably were brought into the study area. Examination of complete flakes with cortex by material documented multiple size modes in both the Organ rhyolite and the miscellaneous coarse-grained material. These multiple modes may reflect differing acquisition strategies.

Cores

Three hundred and forty-two cores were recovered during surface collection and excavation on the project. A core is defined as any lithic item with negative flake scars and no attributes of a flake

or other tool. The four types of cores identified in the Project 90-11 study are:

- Tested pebble: less than 3 flake scars
- Unidirectional core: 3 or more scars removed from a single platform
- Multidirectional core: 3 or more scars, multiple platforms
- Other: split pebbles and bipolar cores

These core types, in combination with observations on core size and cortex percentage, should provide some measure of the intensity of reduction of different material types.

Raw Materials

All 10 raw material classes were represented in the 342 cores on the project. Obsidian was the most common, making up 26 percent of the assemblage. This was followed by the miscellaneous chert class (24.3 percent), chalcedony (11.4 percent), Organ rhyolite (10.5 percent), Franklin rhyolite (5.3 percent), basalt (5.3 percent), Rancheria chert (4.7 percent), miscellaneous (4.6 percent), quartzite (4 percent), and silicified limestone (4 percent). A comparison at the project level of these totals with those of chipped stone (see Table 8.2) suggests that a higher proportion of cores tends to be represented by cryptocrystalline materials. Rancheria chert, which represents 4.7 percent of the cores, but makes up more than 10 percent of all the chipped stone material, is the only cryptocrystalline material underrepresented in the core category. Conversely, with the exception of Organ rhyolite, most coarser materials are underrepresented in the core percentages.

A similar pattern exists for material quality, which is superior to the quality of the project total class, with 22 percent of all cores being of very fine material. This compares to less than 13 percent for the assemblage at the project level. That is, cores are more likely to be made from finer, higher quality materials. This pattern is contrary to the one identified by the debitage analysis where cryptocrystalline materials are more likely to be used for tool production.

This apparent discrepancy is due, in large part, to the frequent presence of obsidian and chalcedony cores in the assemblage. Cores make up only 5 percent of all chipped stone, but more than 15 percent of all obsidian, and more than 9 percent of all chalcedony. The raw materials probably were small nodules that were reduced primarily through a bipolar or split pebble reduction technique. Consequently, any given core produced a small number of flakes, resulting in a high ratio of cores to flakes. Also, as the cores from this type of reduction are often quite small, they were unlikely to be curated, further inflating the core-to-flake relationship.

When the material quality of cores is compared to the rest of the assemblage at the project level, cores are generally inferior (Table 8.4). The quality distinction, running from very fine to very coarse, is subjective and based on internal consistency of a given specimen. Differences in material quality are

Table 8.4. Material Quality, Cores Versus All Chipped Stone.

Material	Very Fine		Fine		Coarse		Very Coarse	
	Cores (%)	All (%)	Cores (%)	All (%)	Cores (%)	All (%)	Cores (%)	All (%)
Basalt	0	0	6	11	94	88	0	0
Chalcedony	0	16	74	76	26	8	0	0
Franklin rhyolite	0	0	11	14	83	81	6	4
Miscellaneous chert	6	17	72	75	22	8	0	0
Miscellaneous coarse	0	0	0	20	94	73	6	7
Obsidian	79	86	21	14	0	0	0	0
Organ rhyolite	0	1	17	34	78	62	6	3
Quartzite	0	0	0	4	100	94	0	2
Rancheria chert	0	5	81	91	19	4	0	0
Silicified limestone/sandstone	0	0	31	53	69	46	0	0

Table 8.5. Core Size Attributes.

Material	#	Maximum Size (cm)	Mean (cm)	Median (cm)	Coefficient of Variation
Basalt	18	9.90	6.29	6.55	27.25
Chalcedony	39	4.40	3.20	3.20	19.51
Franklin rhyolite	18	11.90	5.08	5.50	29.93
Miscellaneous chert	83	9.50	3.84	3.80	31.09
Miscellaneous coarse	16	12.40	7.38	6.55	31.99
Obsidian	89	3.50	2.29	2.30	22.75
Organ rhyolite	36	12.70	5.94	5.20	38.68
Quartzite	14	12.80	6.42	5.85	43.62
Rancheria chert	16	8.60	4.91	4.60	36.17
Silicified limestone	13	12.10	6.43	5.90	33.20
Total	342				

especially apparent among cryptocrystalline materials. Several noncryptocrystalline materials (Franklin rhyolite, quartzite, and basalt) tend to have similar frequencies of material qualities in cores and the rest of the chipped stone assemblage. It appears that most cryptocrystalline cores recovered on the project are of inferior quality compared to the rest of the assemblage, whereas noncryptocrystalline cores tend to be more reflective of the overall assemblage. This pattern may be the result of the discard of poor quality materials and the curation of high quality cores in the cryptocrystalline class. High quality noncryptocrystalline materials, conversely, do not seem to have been removed from the area as often.

Size

The ranges of the mean, maximum, and median sizes of cryptocrystalline materials are generally smaller than those in the crystalline group (Table 8.5). These data suggest that the crystalline materials occurred in larger size ranges and/or were not reduced as extensively as cryptocrystalline materials.

The coefficient of variation, a comparable measure of variations within the material types, suggests that size ranges of chalcedony and obsidian differ only slightly from the remaining materials. This, coupled with the small average sizes of the two materials, is consistent with a size limitation. Results of the raw material survey, as well as other observations of raw materials in the region, suggest that both materials probably occurred as small nodules. The higher coefficients of variation for the remaining materials suggest that a wider variety of initial core sizes were involved. It may be, however, that these materials had a wider array of reduction sequences in combination with a larger initial size. Examination of the cortex patterns on cores of various materials helps clarify this situation.

Cortex

Obsidian and chalcedony, which have small average sizes, have a high frequency of specimens with more than 50 percent cortex (Table 8.6; Figure 8.11). This agrees with the occurrence of materials in small nodule form. Though neither obsidian nor chalcedony was common compared to other raw materials, almost 800 nodules of the two material types were observed in the raw material survey. The size ranges of obsidian (mean = 2.29 centimeters, maximum = 3.5 centimeters) and chalcedony (mean = 3.2, maximum = 4.4 centimeters) cores are within the size ranges of the source survey material. Ninety-eight percent of the obsidian and 92 percent of the chalcedony observed on the survey are less than 3 centimeters. Thus, there is no reason to assume that the obsidian and chalcedony cores recovered on the project are not local in origin.

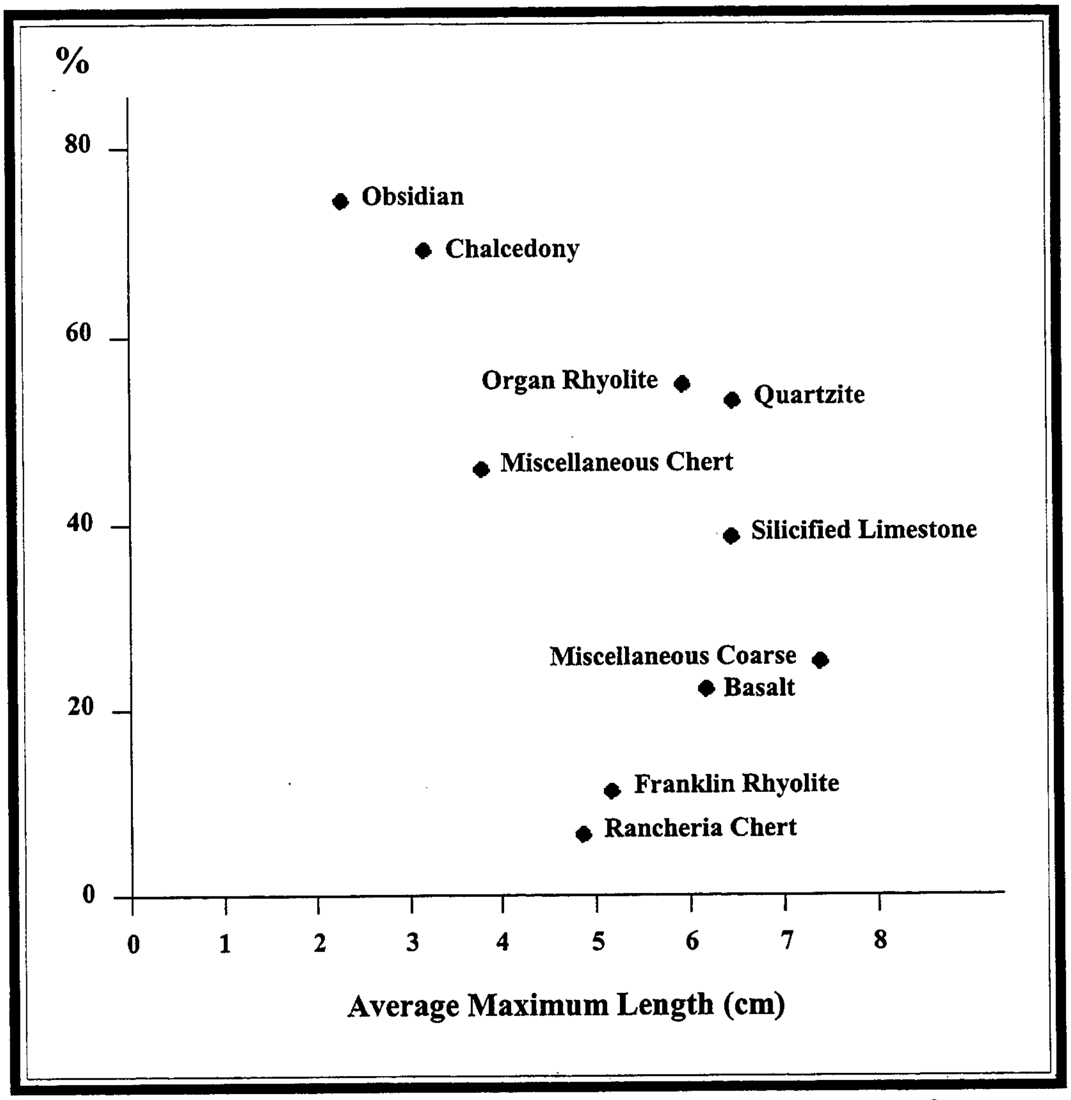

Figure 8.11. Average Maximum Lengths of Cores with More Than 50 Percent Cortex.

Table 8.6. Cortex by Material Type.

Material	#	None	1–50%	51–100%
Basalt	18	27.8	50.0	22.2
Chalcedony	39	2.6	28.2	69.2
Franklin rhyolite	18	5.6	83.3	11.1
Miscellaneous chert	83	10.8	43.4	45.8
Miscellaneous coarse	16	6.3	68.8	25.0
Obsidian	89	0.0	25.8	74.2
Organ rhyolite	36	2.8	44.4	52.8
Quartzite	14	21.4	21.4	57.1
Rancheria chert	16	12.5	81.3	6.3
Silicified limestone/sandstone	13	7.7	53.9	38.5
Total	342			

Cores of Franklin rhyolite, Rancheria chert, basalt, and miscellaneous coarse-grained material have low-to-moderate cortex coverage but are larger in size, a pattern that would be consistent with the importation of large items that have been partially decorticated elsewhere. Most are larger than 5 centimeters, which precludes a significant number coming from local gravels. Given the large sizes, cores from these materials do not seem to have been extensively reduced after the material was brought into the area.

Cores of Organ rhyolite, quartzite, and, to a lesser extent, silicified limestone have moderate amounts of cortex but are also of fairly large size. This suggests a pattern of either local acquisition or importation of materials with substantial cortex. Given the results of the raw material survey, local acquisition is possible only for some of the smaller items of Organ rhyolite. Thus it appears that these materials probably were imported into the area with moderate amounts of cortex, and were not extensively reduced once present in the project area.

Finally, the miscellaneous chert category, which has a moderate amount of cortex and is of average size, may be composed of a variety of acquisition and reduction groups. Some specimens may have been brought into the region with substantial cortex and then reduced, whereas some may have been locally acquired. The size ranges of chert nodules in the raw material survey, in which 95 percent of the miscellaneous chert class was less than 3 centimeters in length, suggests that most probably were brought into the project area.

These size and cortex relationships suggest that cores recovered from the project area probably represent a variety of acquisition strategies. Obsidian and chalcedony may have been collected from local gravels. Others, such as Rancheria chert, Franklin rhyolite, and basalt, probably were brought into the area in a partially cortical condition, and the miscellaneous chert class may reflect both local acquisition and importation from outside the project area.

Many cores may have been used initially as another item such as a hammerstone or ground stone. Similarly, a core may be fire cracked from additional use as a hearthstone. More than 50 percent of the quartzite, Franklin rhyolite, and miscellaneous coarse-grained cores had secondary uses. Between 25 and 40 percent of basalt, Organ rhyolite, silicified limestone, and Rancheria chert cores have moderate other use, mostly as either ground stone or hammerstones. Cores made from obsidian, chalcedony, and materials in the miscellaneous chert group, had little or no other uses.

Other uses should influence variables such as maximum size and cortex (Table 8.7). Size data for obsidian, chalcedony, and miscellaneous chert cores are not considered here, as these materials have few cores with an "other use" designation. A distinction is made between sole use—cores with no other uses noted—and primary use—cores that have been used as either ground stone or hammerstones. Fifteen cores that were subsequently used as hearthstones are not considered in either the sole or primary use groups because their size is likely to have been distorted by their final use.

Table 8.7. Average Core Size by Use Category (All Cores).

Use Categories	Sole Use		Primary Use	
	#	cm	#	cm
Basalt	11	6.07	5	6.42
Franklin rhyolite	8	5.54	7	6.47
Miscellaneous coarse	7	6.47	8	8.18
Organ rhyolite	26	5.64	5	8.28
Quartzite	5	4.74	6	8.90
Rancheria chert	10	4.49	6	6.56
Silicified limestone/sandstone	9	5.77	3	8.20
Total	76		40	

The other use artifact type distinction was made only if there was clear evidence of a use other than as a core. Some cores that lack other use designations, especially the noncryptocrystalline materials that tend to be used for ground stone and hammerstones, may have been derived from ground stone and hammerstones. The other use category, then, underrepresents the actual frequencies of reuse in these materials.

In each raw material type, cores with other primary uses are considerably larger than cores that lack other uses. The sizes of cores, then, are influenced by the sizes of the initial artifact types selected for reuse as cores. The use of the original artifact type—usually a ground stone—for a core represents scavenging or recycling rather than primary acquisition of materials.

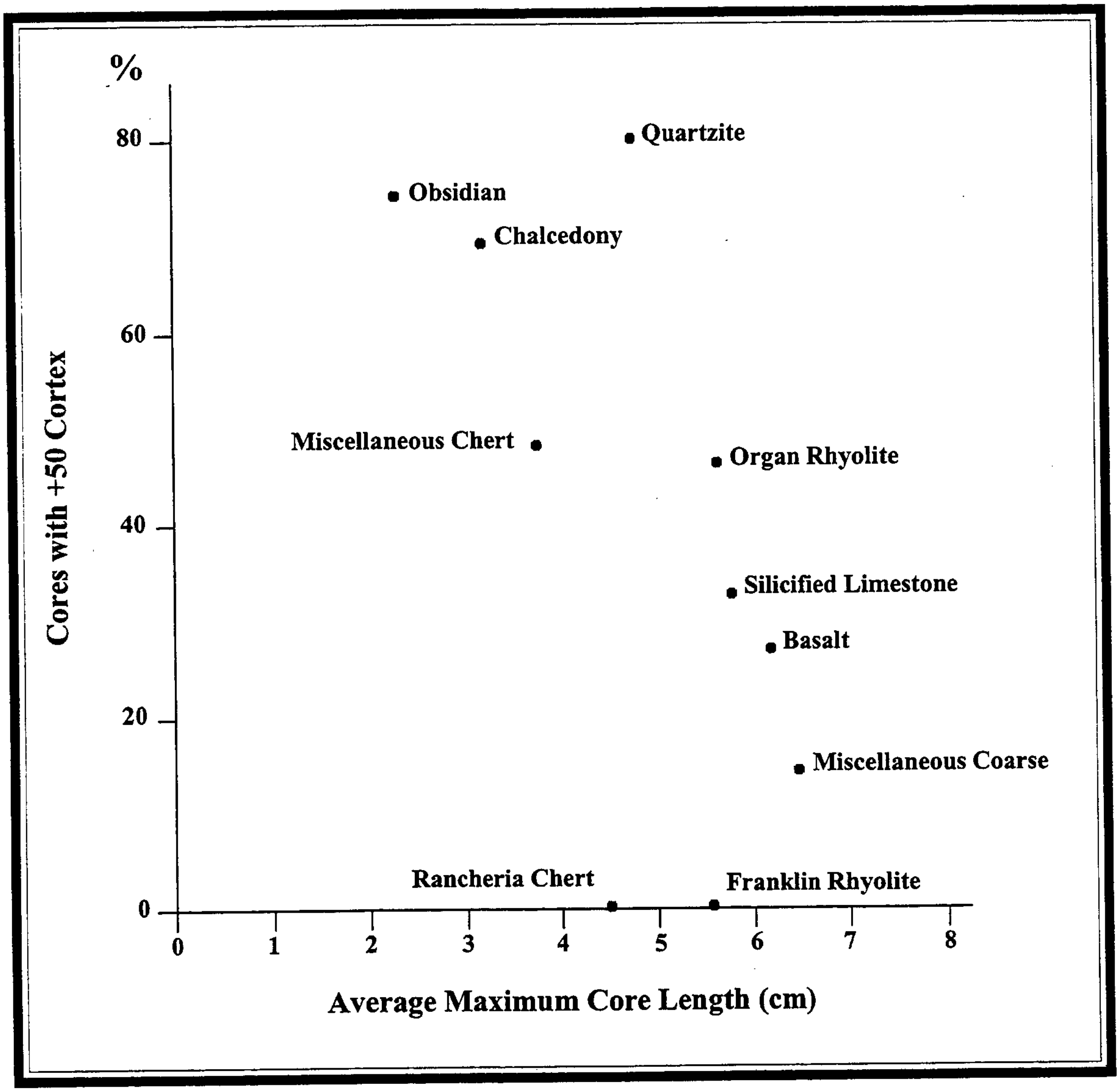

Figure 8.12. Average Maximum Length, Sole Use Cores with More Than 50% Cortex.

The use of ground stone and hammerstones for cores also affects cortex percentages. In most cases, cores that were originally ground stone or hammerstones tend to have a higher frequency of 50-plus percent cortex cover. For example, of the 16 Rancheria chert cores, six have other primary uses. One of the six has a cortex percentage greater than 50 percent. None of the 10 remaining cores has more than 50 percent cortex coverage. Similarly, 46 percent of the 26 Organ rhyolite cores without other primary uses have more than 50 percent cortex coverage; four of the five remaining cores, those with other primary uses, have more than 50 percent cortex coverage. The only major exception to this trend is in quartzite specimens where 80 percent of the five cores have more than 50 percent cortex coverage compared to only half of the six cores that have other primary use designations.

The net effect of eliminating cores with other primary uses from consideration of size and cortex coverage can be seen in Figure 8.12. The major difference is in quartzite, which now has high cortex and a significantly smaller size. Note that 87.5 percent of the 2,464 quartzite specimens observed on the raw material survey are less than 3 centimeters in maximum size; 12.5 percent, or 308 items, are larger than 3 centimeters. Given that the project assemblage

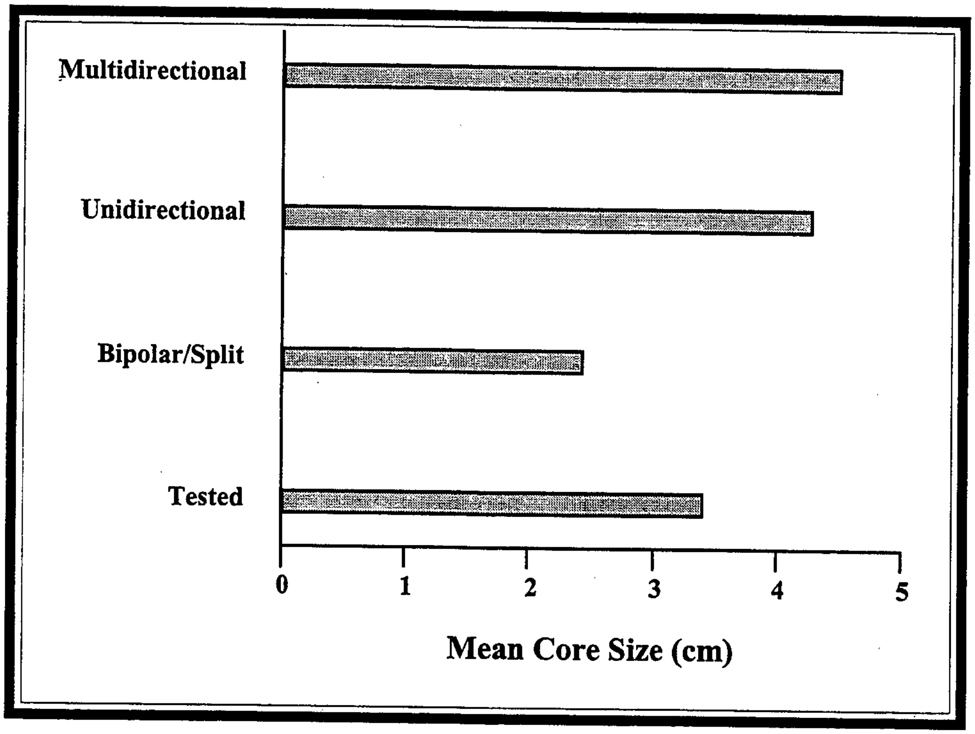

Figure 8.13. Mean Size, Cores without Other Uses.

contained only five quartzite cores, it is certainly possible that they are from local gravels.

The data suggest that of the 278 cores that did not have a previous use, all the obsidian ($N = 89$) and chalcedony ($N = 38$) cores, and a portion of the miscellaneous chert ($N = 83$), quartzite ($N = 5$), and Organ rhyolite ($N = 26$) cores, could have been obtained from local gravels. The size range and cortex coverage of these items are consistent with the patterns seen in the raw material surveys. This suggests that a minimum of 45 percent and probably well over 75 percent of the project cores may have been acquired from local gravels or scavenged from other artifact types. Acquisition of cores from surrounding mountains and alluvial fans may be fairly limited. Only Rancheria chert ($N = 16$), silicified limestone ($N = 13$), and a portion of the miscellaneous chert group ($N = 83$) cannot be acquired from the surrounding environment at the present time.

Types

The four core types identified on the project (tested pebble or cobble, unidirectional, multidirectional, and other split pebbles and bipolar) were designed to measure the intensity and form of reduction on different material types. Multidirectional cores make up just over 42 percent of the core sample; split pebbles and bipolar cores, 32 percent; tested pebbles or cobbles, 22 percent; and unidirectional cores, 4 percent. Strong relationships between core types and materials primarily demonstrate the dominance of obsidian in the miscellaneous core class. Obsidian accounts for 32 percent of the cores but makes up 58 percent of the split pebble and bipolar core category because of the frequent use of a bipolar or split pebble technique for reducing small nodules. Chalcedony is overrepresented in the tested pebble range, making up 28 percent of all tested pebbles, although it accounts for less than 14 percent of the core sample. Finally, crystalline materials tend to be overrepresented in the multidirectional core group. As a class, these material types make up 24 percent of the total sample, but account for 36 percent of the multidirectional cores. Rancheria chert and miscellaneous chert, which also are overrepresented in this class, account for almost 41 percent of multidirectional cores, but make up only 30.5 percent of the core sample. Core types from the project area, then, may not provide an adequate measure of reduction intensity, but they seem to correspond with raw material size (Figure 8.13).

Cortex coverage and core type also are strongly related. Cortex coverage of more than 50 percent is more common in tested pebbles and miscellaneous

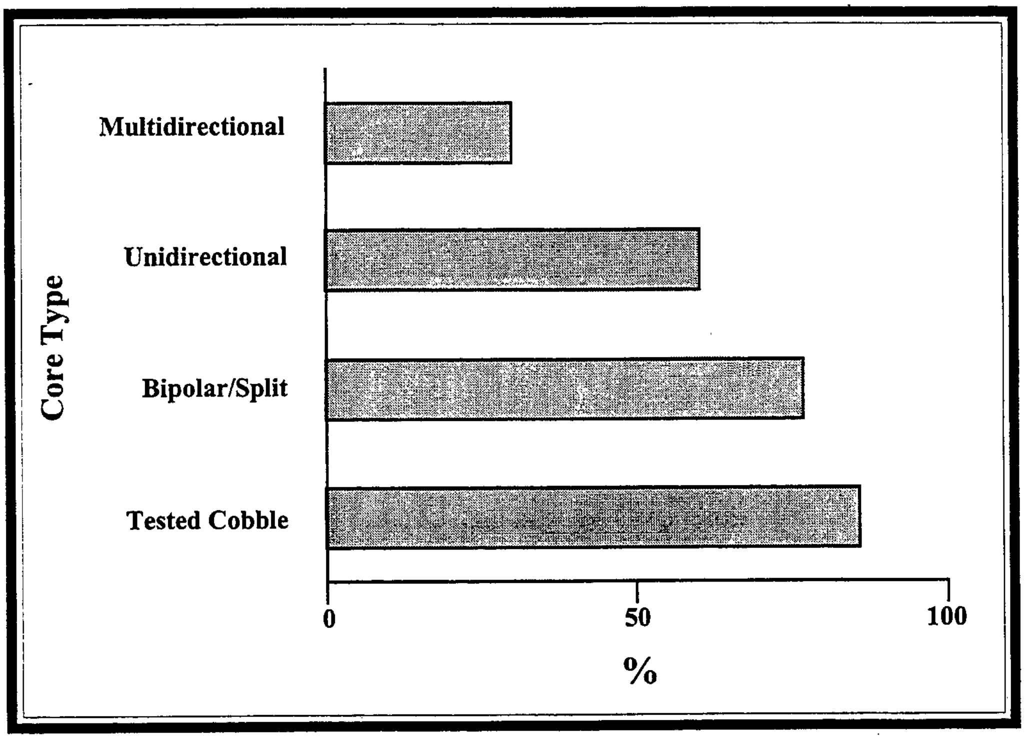

Figure 8.14. Core Types with 51–100% Cortex and No Other Uses.

core types (Figure 8.14), probably because of the frequent use of these techniques on small nodules. Unidirectional and multidirectional cores, however, have fewer cores with more than 50 percent cortex—even though they are larger. They are associated with coarser materials more often than expected. Rancheria chert and the miscellaneous chert categories make up a significant component of this group, accounting for 41 percent of the 118 specimens. Given the larger average size and the lower frequency of cortex, some portion of these 118 cores may represent material reduced elsewhere and brought into the study area.

Finally, size distributions of each core type were compared to raw materials to determine any bimodality that suggested a subclass of exhausted cores or a difference in source material size. In two cases, more than one size mode is clearly visible. The first is a break in the 3.75-centimeter size range of miscellaneous chert and miscellaneous cores (Figure 8.15). Those under 3.75 centimeters have some cortex present, with 65 percent having more than 50 percent cortex coverage. These are not exhausted cores, but appear to have been small nodules originally. The small group that falls within the size range of the local gravels probably represents local acquisition. The larger size class, which is composed of only four items, also has a high frequency of cortex coverage. This size range, although present in the local gravels, is not common. It could represent local acquisition or it could be specimens brought into the study area and discarded after minimal use.

Three size classes are apparent in the Organ rhyolite multidirectional cores (Figure 8.16). The first, cores less than 5.5 centimeters in maximum size, contains six items. All have cortex and 67 percent have more than 50 percent cortex coverage. This size mode probably represents acquisition from local gravels. The second size mode, 5.5 centimeters to 8.0 centimeters ($N = 5$), and the third size mode, greater than 8.0 centimeters ($N = 3$), probably represent materials brought into the study area. They are beyond the size ranges common in the local gravels and all have cortex, though none have more than 50 percent surface coverage. These are probably items brought into the area after being initially reduced elsewhere.

A comparison of cores relative to major landforms for the 16 projects identified in the raw material discussion does not indicate a strong pattern at a landform level. Cores tend to make up a slightly higher percentage of assemblages along the Rio

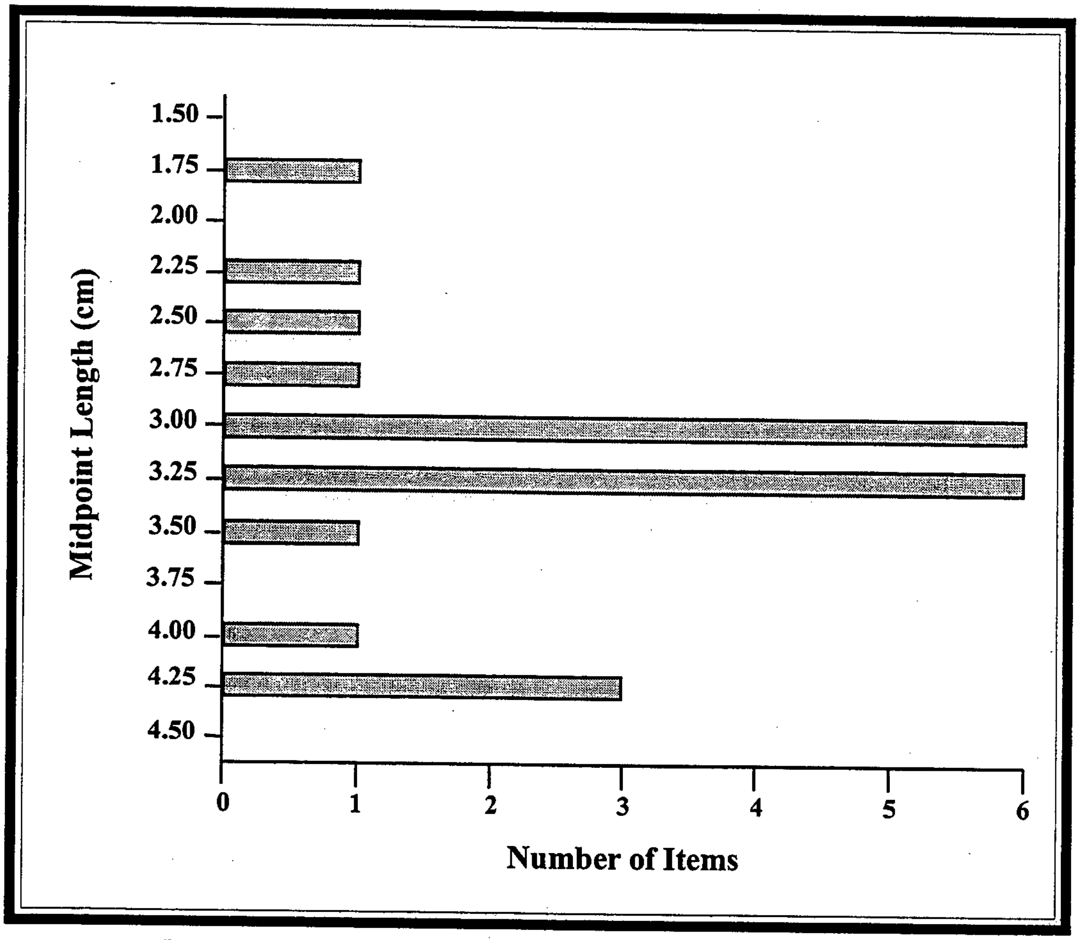

Figure 8.15. Core Length Modality, Miscellaneous Cherts and Cores.

Grande and West Mesa, but differences within any given landform are considerable. These differences may result from definitions of cores, or they may reflect actual distribution.

Discussion

Core analysis complements debitage analysis in identification of a series of raw materials that were probably acquired from local gravels, a series that may represent scavenging, and a component that may have been brought into the study area with additional reduction activities as a goal. Strong relationships that exist between core type and raw materials are probably related to initial raw material size.

Hammerstones

Approximately 200 items recovered from the project area are classified as hammerstones for either sole or primary use. Hammerstones may be associated with either flake removal or the preparation or refurbishing of ground stone. They also may be used directly as tools for breaking bone and in some plant processing. A distinction is made between "true" hammerstones that were probably used in chipped stone production and/or ground stone refurbishing and specimens that have evidence of hammering but probably were shaped ground stone. Often, the latter group has ground surfaces and is classified as ground stone; they are discussed in the ground stone section of this chapter. Thirty-two percent of the specimens have evidence of shaping but lack ground surfaces. These are probably fragments that resulted from attempts to refurbish or shape ground stone. They are discussed in this section, but form a different category than hammerstones as such. Eliminating the shaped or pecked specimens leaves 68 percent that probably were used either to remove flakes from cores or tools or to refurbish shaped ground stone fragments. The analytical potential of this tool class is diminished by the fragmentary nature of the group; less than 1 percent of the hammerstones and none of

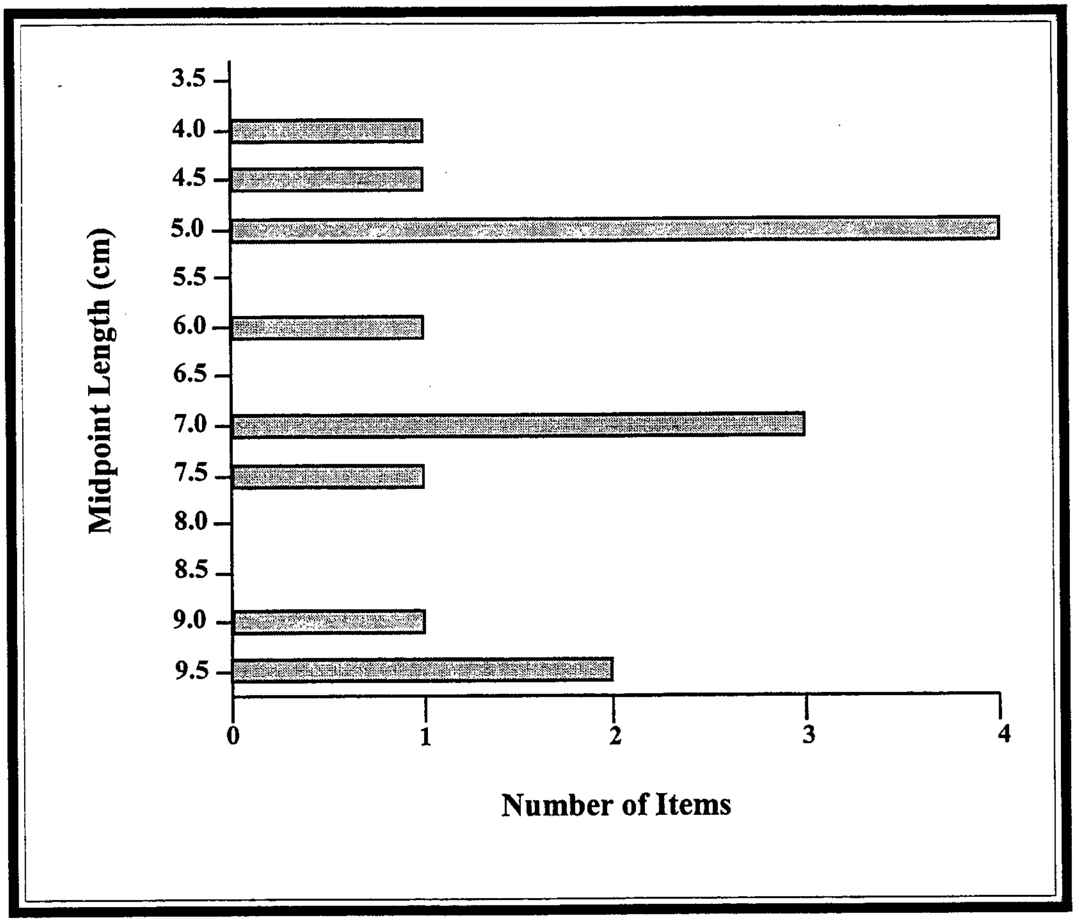

Figure 8.16. Core Length Modality, Multidirectional Cores of Organ Rhyolite.

the pecked or shaped specimens are complete. In addition, 68 percent of the hammerstones have other uses, the most frequent of which is as hearthstones.

Coarse, durable materials dominate the assemblage (Table 8.8), with Franklin rhyolite making up over 40 percent. Over 95 percent of the material is in the coarse to very coarse category. The average specimen size suggests that most could not have come from local gravels. This is even more apparent because the assemblage is extremely fragmentary, with almost all specimens being broken.

Most hammerstone fragments also have cortex. Only five specimens—less than 4 percent of the assemblage—lack cortex, and all are incomplete. Almost 50 percent of the hammerstones have more than 50 percent cortex coverage.

Patterns in the pecked or shaped hammerstone specimens, all of which are fragmentary, are similar to the true hammerstones. Cortex is present on 95

Table 8.8. True Hammerstone Size and Material.

Material	#	%	Average (cm)
Basalt	15	11.0	6.1
Franklin rhyolite	55	40.4	6.0
Miscellaneous chert	8	5.9	6.1
Miscellaneous granular	33	24.3	7.6
Organ rhyolite	4	2.9	5.5
Quartzite	15	11.0	6.4
Rancheria chert	4	2.9	4.9
Silicified limestone/sandstone	2	1.5	6.0
Total	136	99.9	

percent of the assemblage, and it is dominated by coarse-grained materials. Unlike the true hammerstones, however, the assemblage tends to be dominated by quartzite, basalt, and miscellaneous coarse-grained material. These three types make up over 85 percent of the assemblage. Franklin rhyolite, which dominates the true hammerstones, comprises only 12.7 percent of the pecked or shaped category. This is expected if the pecked or shaped category is related to ground stone maintenance or shaping. The material types are those most frequently represented in the ground stone class.

When contrasted with the 16 comparative assemblages, hammerstones are slightly more common in the central basin, making up on average 1.8 percent of project level assemblages. Along the Rio Grande and West Mesa area, hammerstones average 1.4 percent, whereas along the Franklin fans, they account for only 0.3 percent of the assemblage.

To summarize, the hammerstone assemblage is dominated by coarse, durable, low-quality material. The assemblage is extremely fragmentary, with almost all specimens being broken. They frequently were reused, mostly as hearth rock. The large sizes and cortex patterns suggest that they were transported into the study area.

Informal and Formal Tools

A distinction made between formal and informal tools is that formal tools involve some degree of facial or marginal retouch. Four formal tool groups, identified by the amount and/or location of retouch, are: unimarginal, bimarginal, unifacial, and bifacial retouched specimens. Projectile points, defined as bifaces with evidence of hafting, also are separated. Specimens of formal tools are not classified as utilized flakes, though they may be utilized.

The informal tool class comprises utilized flakes and pieces of debris that have indications of use. Utilized flakes, which are expedient tools that saw little investment in producing a specific form, are by far the most common chipped stone tools, accounting for over 60 percent of the total assemblage (Figure 8.17).

The informal tool class is divided into two morphological and reduction types: utilized debris and utilized flakes. These are expedient tool forms that require little time to produce. Conversely, although an extensive amount of time is not involved in production, formal tools are more costly to produce than informal tools. Figures 8.18 and 8.19 illustrate several formal tools recovered from Project 90-11.

A comparison of material types by tool group suggests that informal tools are more likely to be composed of noncryptocrystalline material, and formal tools are more likely to be composed of cryptocrystalline materials. Cryptocrystalline materials, which make up 57 percent of all tools, account for less than 54 percent of the informal tool class and more than 64 percent of the formal tool class. This selection is probably related in part to the workability of the cryptocrystalline materials.

Figure 8.20 illustrates the interquartile size range of complete formal and informal tool types by material type. Complete tools make up about 52 percent of all tools recovered. The interquartile range contains 50 percent of all the cases, with 25 percent above the upper quartile, and 25 percent below the lower quartile. Thus, the range encompasses 50 percent of the tools. Formal tools are consistently larger than informal tools for any given material type, and formal tools in the coarse-grained material groups (for example, quartzite, basalt) are often quite large.

Informal tools of obsidian, chalcedony, miscellaneous chert, and a small portion of Rancheria chert are below the 3-centimeter size range, a range consistent with much of the locally available gravels. However, with the exception of obsidian, the interquartile range for all formal tools in these material groups is well above the 3-centimeter range. In the case of chalcedony, a clear size break between the two groups of tools suggests that some formal tools were transported into the area, perhaps in finished or nearly finished form, whereas many of the informal tools may have been produced from local gravels. Informal tools also could have been produced by reduction of formal tools, but larger samples and a more detailed lithic analysis would be required to prove this theory.

Use and Edge Angles Patterns

Edge use and edge angle were investigated on 914 of the 940 chipped stone tools recovered from sites in the project area. A high percentage of tools (37 percent) had more than one edge utilized, and several specimens had three utilized edges. A total of 1,249 edges was available for analysis.

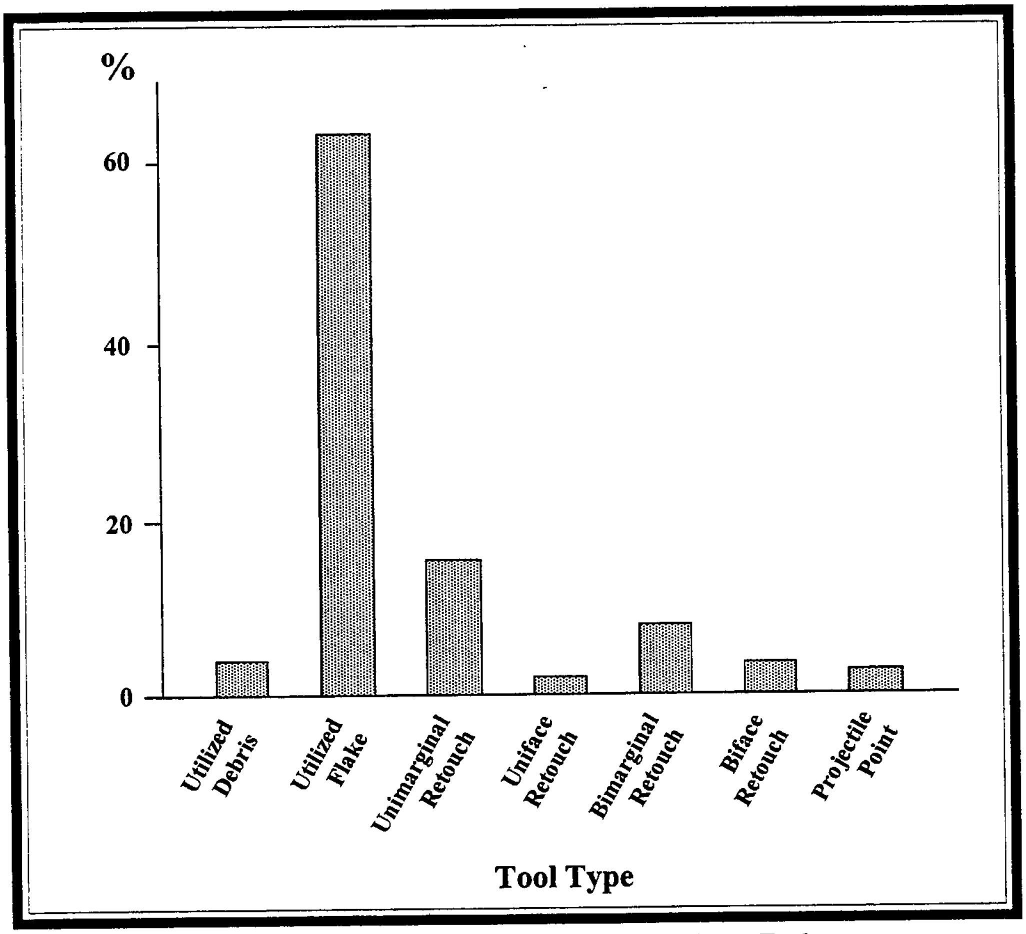

Figure 8.17. Morphological Types, Chipped Stone Tools.

On each edge that was either retouched or used, the angle was measured using a contact goniometer. Edges were placed into one of three categories: angles less then 40 degrees, angles between 40 and 60 degrees, and angles greater than 60 degrees. The classes are thought to be appropriate for certain ranges of tasks, with edges in the sharp group (less than 40 degrees) more appropriate for cutting and scraping and edges in the greater than 60 degree range more suited for pounding and maintenance tasks requiring a durable edge. Edges with average angles between 40 and 60 degrees may reflect a more general activity set (Nelson 1981; Wilmsen 1970).

The type of use on utilized specimens was examined as an additional check on the edge angle measurements. Tools with sharp edges were expected to have a high frequency of damage such as feather and step scars that may be associated with cutting and/or scraping. Those with more obtuse angles should be associated with edge damage such as the pounding or battering more consistent with heavier tasks. Artifacts suspected to have edge damage were sorted by visual inspection and then examined with a binocular microscope. Nine types of edge damage were noted, including various combinations of feather and step damage, edge rounding, battering and crushing, and polishing. These were combined into five groups for analysis.

The first category, battering, contained specimens with edge rounding or crushing and no feather or step microfractures along an edge. The second group contained feather and/or step microfractures with evidence of edge rounding. The third group contained specimens with feather and/or step fractures and no other edge damage, and the fourth group had this same fracture pattern with the addition of polishing. The last group included retouched tools with no visible use.

Edges characterized by dull angles (+60 degrees) account for just more than 35 percent of the

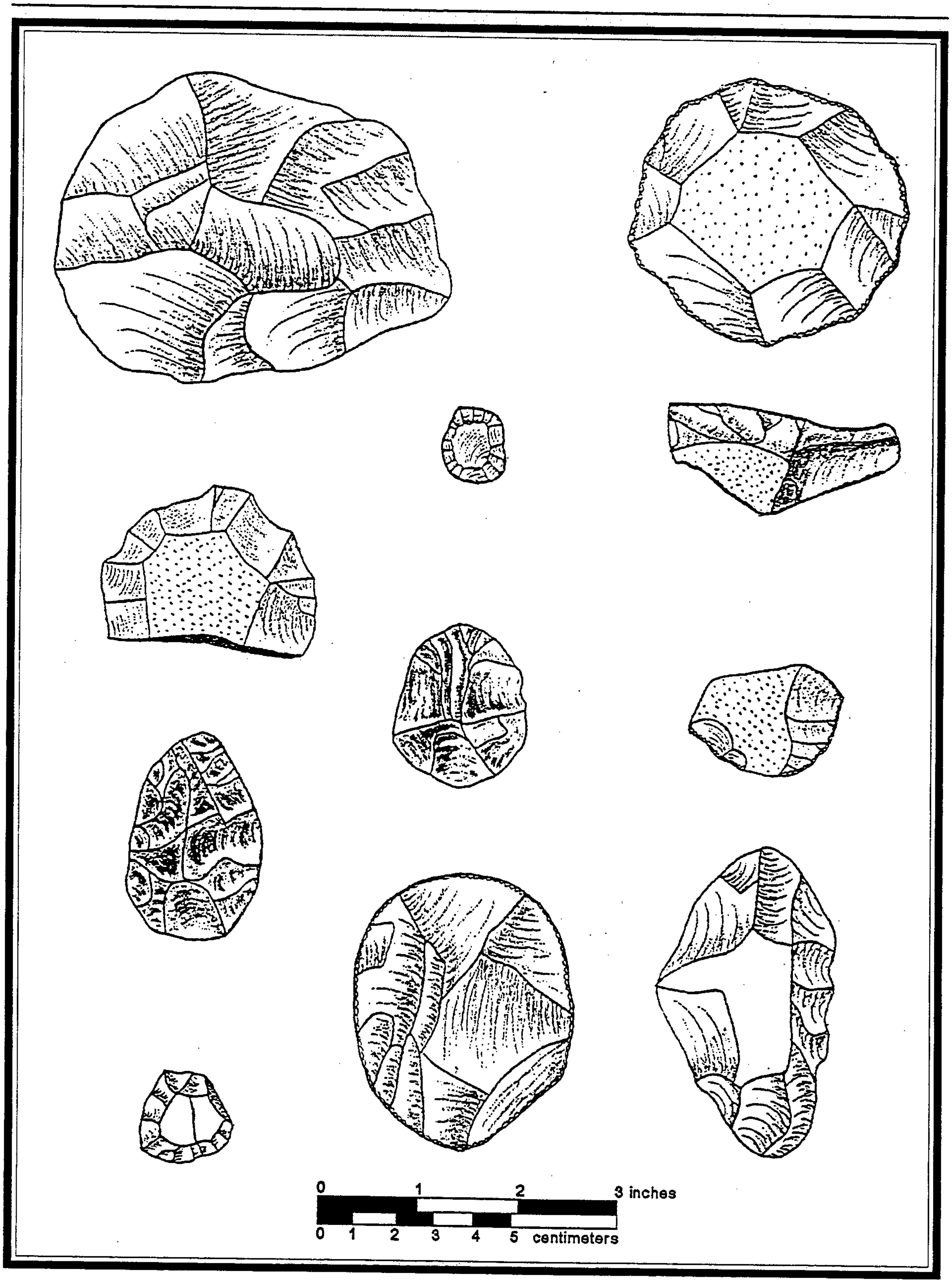

Figure 8.18. Formal tools, Project 90-11.

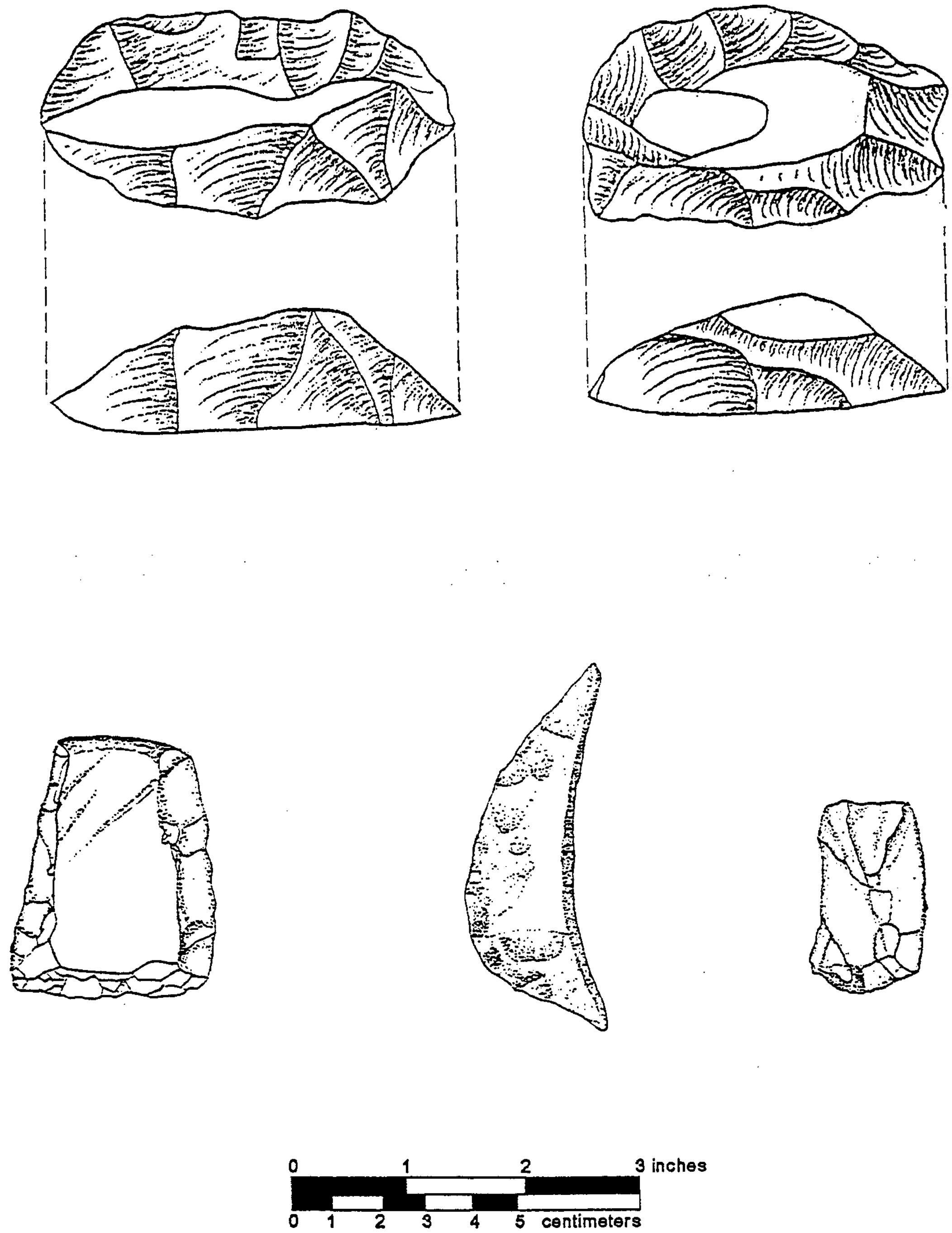

Figure 8.19. Formal tools, Project 90-11.

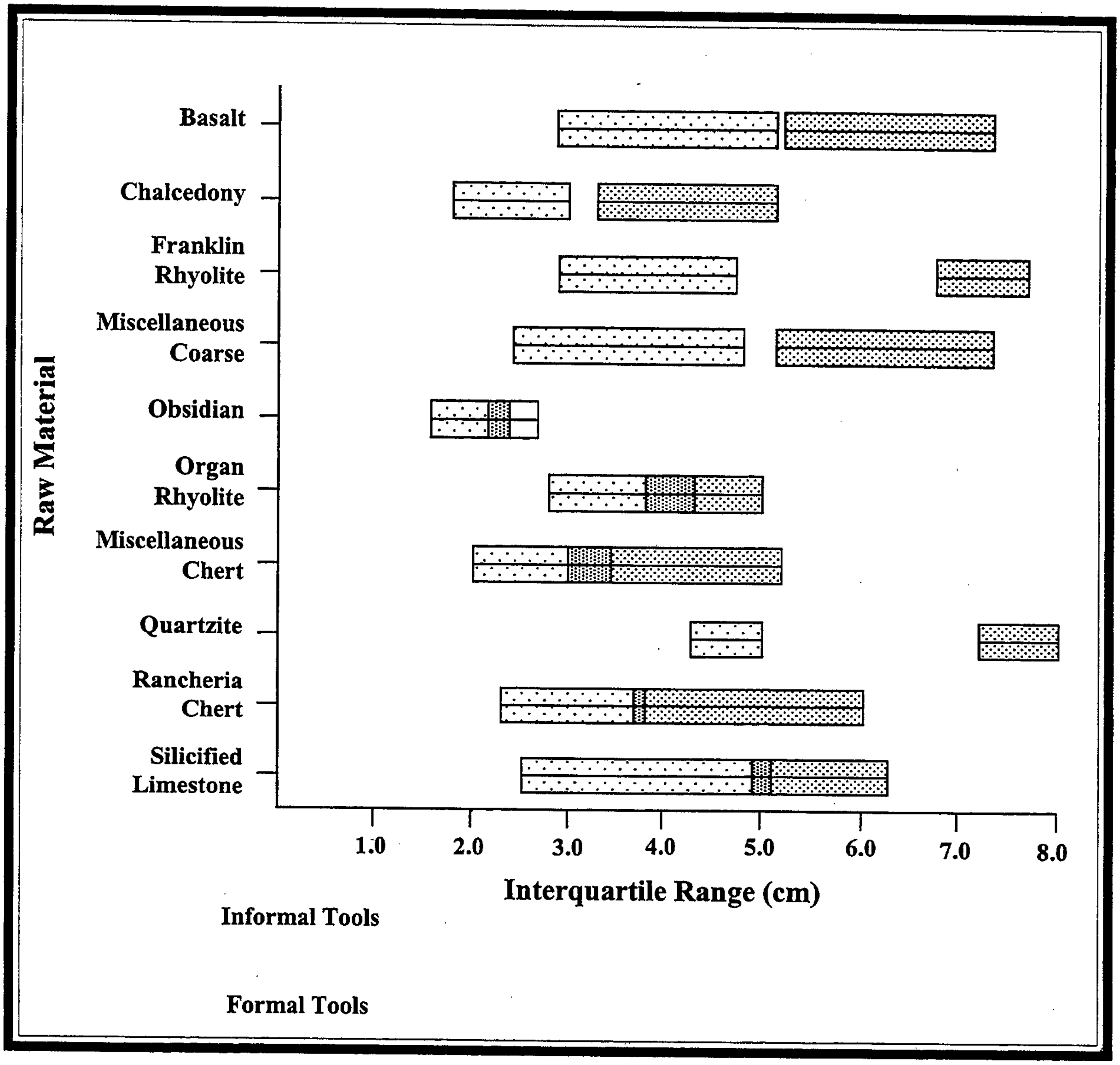

Figure 8.20. Interquartile Ranges of Formal and Informal Tools Compared by Material.

edges. Sharp angles also were frequent, occurring on slightly fewer than 35 percent. Angles in the intermediate group account for about 30 percent. The similarity in these groups may suggest that a variety of tasks requiring a variety of edge angles were conducted in the project area. Angles associated with feather and/or step fracture rounding edge damage are the most frequent, accounting for approximately 43 percent of all edges; edges with battering damage are the least frequent of those with any wear or damage, accounting for fewer than 13 percent of the edges (Figure 8.21).

Within the primary edge damage category there is a strong relationship between material types and edge damage groups when all cryptocrystalline materials are combined and compared with coarse-grained materials. Figure 8.22 shows the expected and actual percentages of all fine-grained materials in the four major use classes. Fine-grained materials were expected to make up 57 percent of the tools, and the coarse-grained pattern should be a mirror image of this figure. There is a strong relationship between edge damage and material grade, with cryptocrystalline materials having a higher than expected

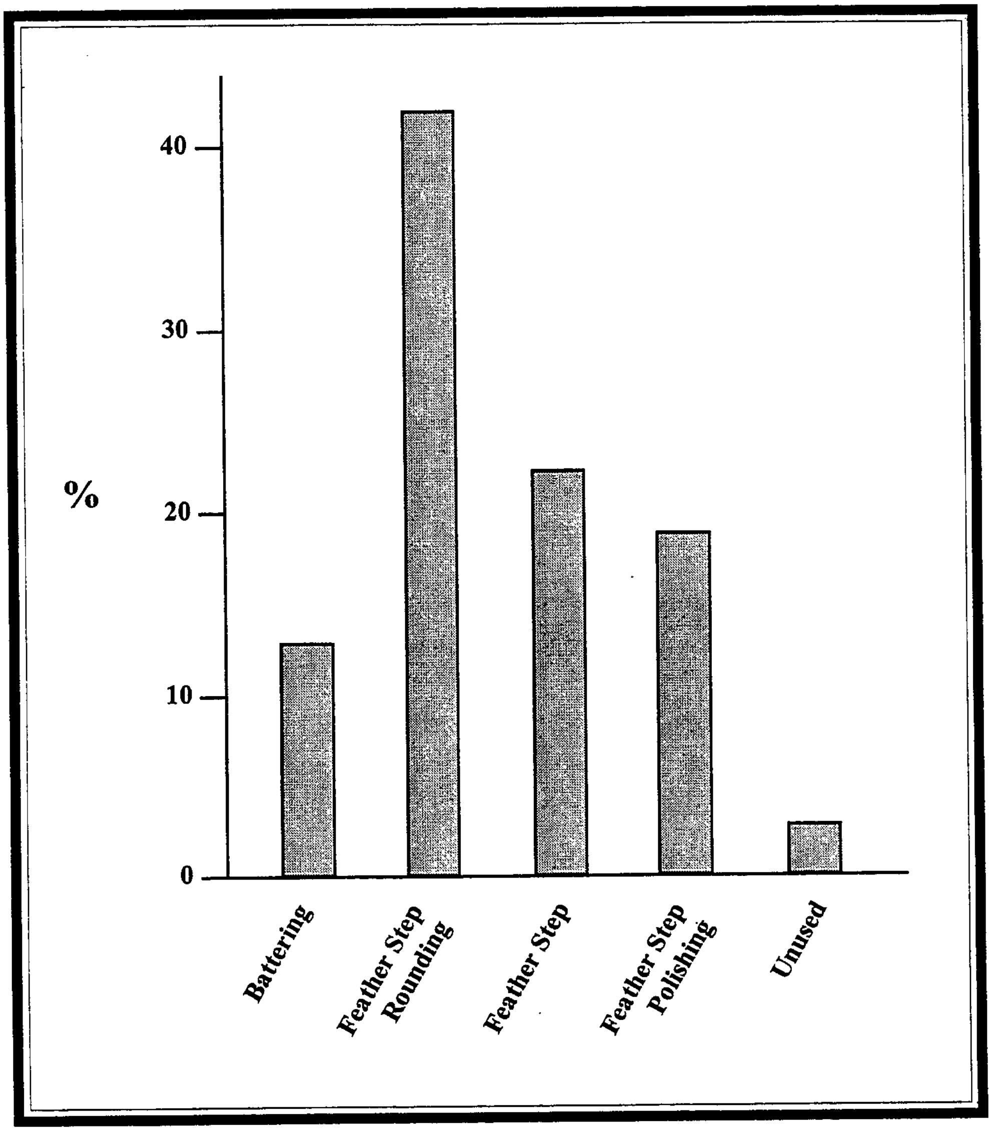

Figure 8.21. Use-Wear on Project 90-11 Tools.

frequency of feather and step polishing damage and feather and step damage, and a lower than expected frequency of feather and step rounding and evidence of battering. That is, cryptocrystalline materials seem to have been selected for tasks that produced feather step retouch and feather and step polishing damage. Conversely, coarse materials seem to be associated with battering and feather and step rounding edge damage. The overall relationship is statistically significant (chi-square = 119; $p > 0.001$; df = 4).

Size differences are consistent with the observed wear patterns; that is, the average length of tools by primary edge damage group increases as evidence of battering and/or pounding increases. The average size for tools with primary use in the feather and step polish group is 2.93 centimeters. This increases to 3.11 centimeters for the feather and step group, 3.71 centimeters for the feather and step rounding group, and 4.85 centimeters for the battering edge damage group. This is related, in part, to the greater use of coarse materials in tasks that produce rounding and battering damage. These materials occur in larger sizes in the project assemblage, and tend to be, because of their material structure, more durable and better suited for pounding or battering activities.

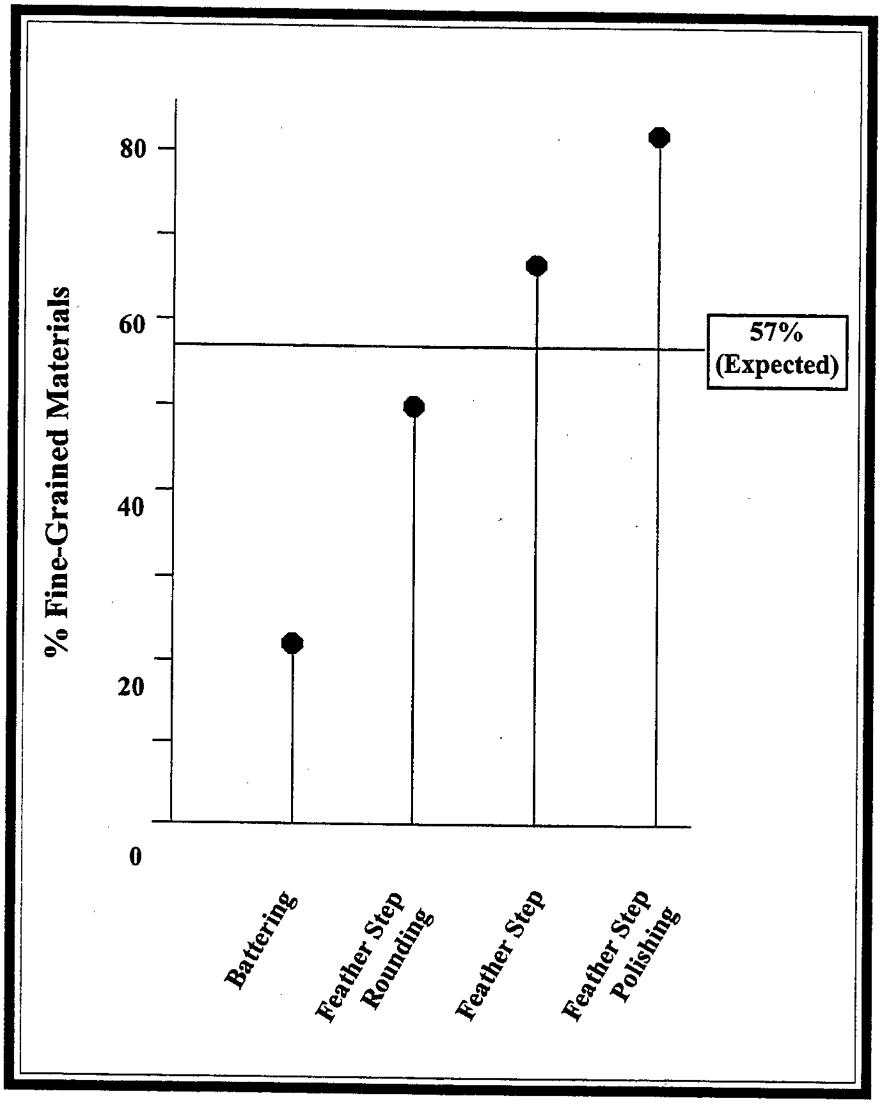

Figure 8.22. Edge Damage Patterns of Fine-Grained Materials.

Unfortunately, it is impossible to tie specific edge damage patterns to little more than a gross distinction in activities. Studies suggest that polishing can result from both silica build up produced during plant processing (Semenov 1964) and hide scraping and wood working (Shea 1992). Feather and step fractures may be produced by working a wide variety of materials as well. The stone materials themselves greatly influence the fracture and light reflective patterns.

A statistically significant association between edge angle and edge use can be demonstrated by chi-square test. Trends in patterns are as anticipated, but the differences are not dramatic. For example, sharp edges have a greater than expected frequency of both the feather and step edges and feather and step rounding wear. In the two groups, 283 sharp angle tools were expected, but the project assemblage has 316. A higher than expected frequency of rounding and battering, again as expected, characterized obtuse angles, with an expected frequency of 58 and an actual frequency of 69. Finally, for intermediate angles associated with feather and step polishing edge damage, 67 tools were expected, but the actual number is 92. The patterns of association suggest some level of support for angle and use groups, but the associations are certainly not exclusive.

A tool may have attributes of more than one task, with edge angles appropriate for maintenance activities characterized by dull but durable edges, and sharp edges appropriate for cutting or scraping activities. Tools, rather than edges, were classified as appropriate for cutting or scraping activities if all edges were sharp; conversely, if all edges on a given tool were dull, it was classified as potentially having been involved in maintenance tasks. All other tool and edge angle combinations were classified as general activities.

Using these criteria, cutting and scraping activities were represented by 349 specimens, or roughly 38 percent of all tools. The multiple activity group was represented by 34 percent of the 914 tools, and the maintenance group made up the remaining 28 percent. As expected, the average sizes of the tool groups vary. Tools in the cutting and scraping group have an average length of 2.82 centimeters, and the general maintenance tool group has an average length of 4.49 centimeters. The larger overall size is expected for the general maintenance class because it should be characterized by more battering and pounding activities. The mixed group had an average length of 3.67 centimeters. Finally, utilized flakes and debris make up the cutting and scraping group. Of the 349 tools identified as exclusively involved with cutting and scraping activities, 348 are utilized flakes. Utilized flakes are also involved in the mixed activity group and the general maintenance group, but these are composed disproportionately of retouched specimens.

Immunological Results and Tool Attributes

In an attempt to identify the relationship between tool forms and tool use, 70 utilized tools were submitted to Dr. Margaret Newman of the Laboratory of Archaeological Science in Bakersfield, California, for blood residue analyses (Appendix H). Sixty-eight artifacts are from archaeological context and two are modern artifacts manufactured and used to cut up rabbits. Newman was not aware of the two modern artifacts in the sample.

The results of the immunological analyses are somewhat disappointing; positive results were obtained on only 13 of the 68 prehistoric artifacts. Blood residue was found on both modern samples, one that was correctly identified as rabbit and the other, which was incorrectly identified as turkey. Reasons for the misidentification are not known.

Positive results to deer antiserum were obtained on four artifacts, and three tested positive for dog antiserum (for example, coyote, fox, or dog). Rabbit blood was identified on a single prehistoric artifact. Three artifacts had positive reactions to guinea-pig antiserum, which Newman suggests may represent several families within the order Rodentia, the most likely of which is porcupine (Erethizontidae). Two additional reactions in the order, one to mouse and the other to rat antiserum, were obtained. A positive result to human antiserum was obtained on one artifact. This probably represents an accident during tool production, an event all too familiar to those who do replication experiments. The absence of identifiable blood residue on almost 81 percent of the prehistoric artifacts may be the result of poor preservation or the use of artifacts on species not covered in the current range of antisera.

Given the low variety and number of specimens with residue and the potential ambiguity of assigning specific species to a given tool residue, use-wear characteristics were contrasted with the presence or absence of animal residue (Table 8.9). Only tools with a single type of wear were considered. The feather and step polish wear type is present on 22 percent of the tools submitted for analysis, but it accounts for 38.5 percent of all the samples with identified animal blood residue. Nelson (1981) discusses a possible relationship between the use of fine quality materials, which are most common to the feather and step polishing group, and animal processing. The association with blood residue may make sense because these are the types of materials that may be more effective for cutting or scraping activities associated with animal processing. The negative association between battering and feather and step rounding use with the recovery of blood residue may suggest that these classes were used in plant production or the production and/or maintenance of wood tools, and possibly maintenance of ground stone tools.

Table 8.9. Edge Damage Patterns and Animal Residue.

Wear Pattern	Residue Absent	Residue Present
Rounding/battering	8	1
Feather/step	11	3
Feather/step and rounding	19	4
Feather/step and polishing	8	5
Total	46	13

Relationships between edge angle and residue recovery rates produced relationships contrary to those expected (Table 8.10). Residue was recovered more frequently on tools with dull angles, a group that makes up 22 percent of the tools submitted, but accounts for 41 percent of all artifacts containing residue. It would be expected, however, that sharp angled tools would be more commonly associated with animal residue. This may be a function of sample size, but it also may be that either the edge angle data is not related to animal or plant use as was anticipated or that a specific form of processing is indicated. In light of the latter suggestion, it is interesting that three of the four samples with deer residue have dull angles.

Table 8.10. Edge Angle and Animal Residue.

Edge Angle	Residue Absent	Residue Present
Sharp	17	3
Intermediate	19	3
Dull	10	7
Total	46	13

Intraproject Patterns

To this point, project level patterns have been the exclusive focus, with minimal comparisons to aspects of the regional data base. In this section, several patterns discernible within the project are considered. The first is the three landforms within the project area. This is followed by examination of the relationship between cluster and noncluster materials.

Medial thickness of noncortical medial-distal fragments and the medial thickness of flakes with multifaceted platforms were examined for evidence for tool production. The southern and northern sections of the project area have more evidence for tool production than the playa ridge landform, which seems to be characterized by core reduction (Figure 8.23). The dominance of tool production in the southern area is supported by data on the percentage of fine-grained raw materials. Obsidian, cherts, and chalcedony are more common in the southern region, accounting for 48.6 percent of the materials. Conversely, the playa ridge had a higher frequency of coarse-grained materials, with obsidian, chalcedony, and cherts making up 43.4 percent of the material. This pattern is consistent with the thickness values in Figure 8.23. Coarse-grained materials are less likely to be used in the production of formal tools. However, in contrast to the flake thickness values, which suggest that the northern area had more tool production debitage, fine-grained materials commonly used in the production of formal tools were not common in the north, accounting for only 39.7 percent of the assemblage. The reasons for these differences are unknown.

Table 8.11 compares the expected and observed artifacts by landform within the project. The expected number of artifacts within a given class is from the marginal totals assuming there is no association between landform and artifact type. The data suggest that major differences in artifacts are relative to location, with site assemblages along the playa

Table 8.11. Artifact Classes by Location.

	Land Form						
Artifact Class	North		Playa Ridge		South		Total
	Actual	Expected	Actual	Expected	Actual	Expected	Actual
Cores	16	28	176	114	150	201	343
Flakes	472	431	1,616	1,747	3,179	3,088	5,267
Formal tools	20	24	124	98	150	172	294
Hammerstones	12	16	87	66	99	116	198
Informal tools	32	53	235	214	379	379	646
Total	552		2,239		3,956		6,748
Percentage	8.2		33.2		58.6		100.0

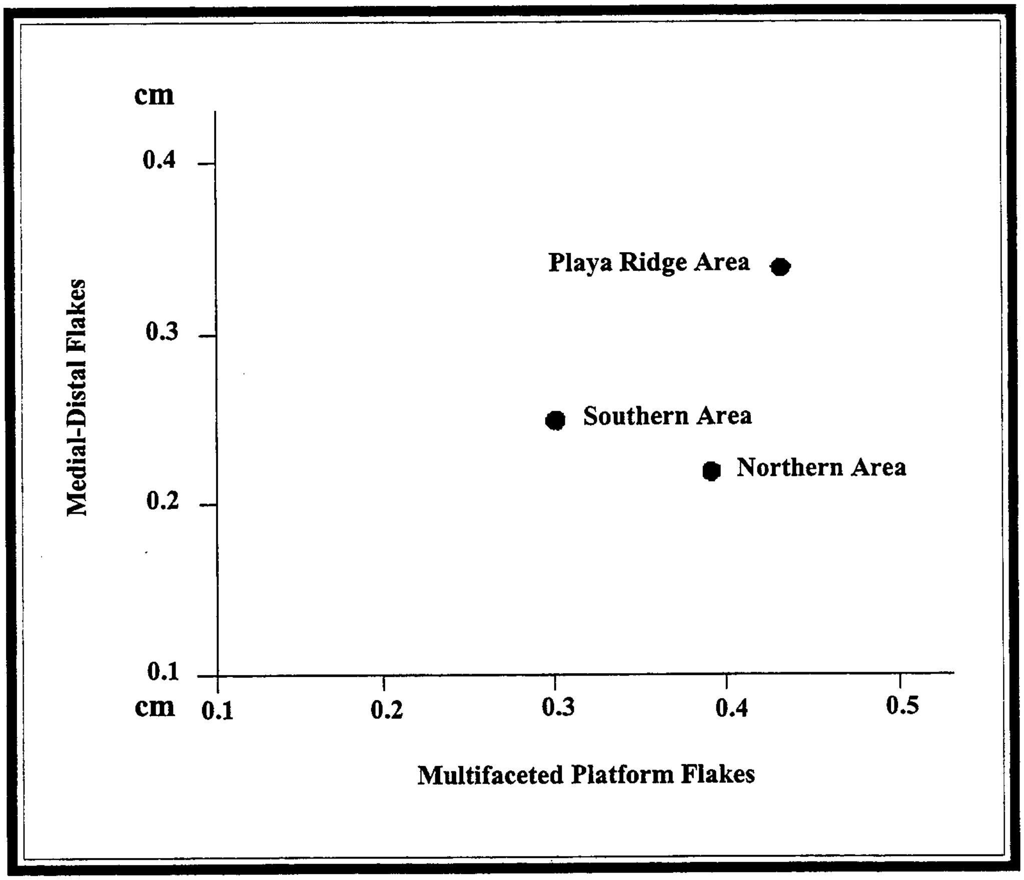

Figure 8.23. Median Thickness, Medial-Distal Fragments and Multifaceted Platform Flakes.

ridge having more cores (177 actual to 114 expected), more formal tools, more informal tools, more hammerstones, and fewer flakes. Site assemblages from the southern section of the project not associated with the playa ridge have fewer cores, formal tools, and hammerstones, with more flakes; the northern area assemblages contain fewer cores, fewer informal tools, and more flakes.

The percentage of each tool class made up of fine-grained materials was related to locations in the project area (Figure 8.24). The expected percentage was derived from the project totals, and differences from the expected denote a greater or lesser use of fine-grained materials within an area to produce a given artifact class. Cores and formal tools along the playa ridge area were much more frequently made of fine-grain material, yet higher quality flakes were not common. Fine quality raw materials used for cores and flake debitage were underrepresented in the northern area, with formal tools being over-represented. The southern area had more high quality materials in the flake debitage, but fewer high quality materials were used as cores and in formal tools. Finally, there is no major difference in the use of high quality materials in informal tools. Only the northern area has more informal tools made of high quality stone than expected.

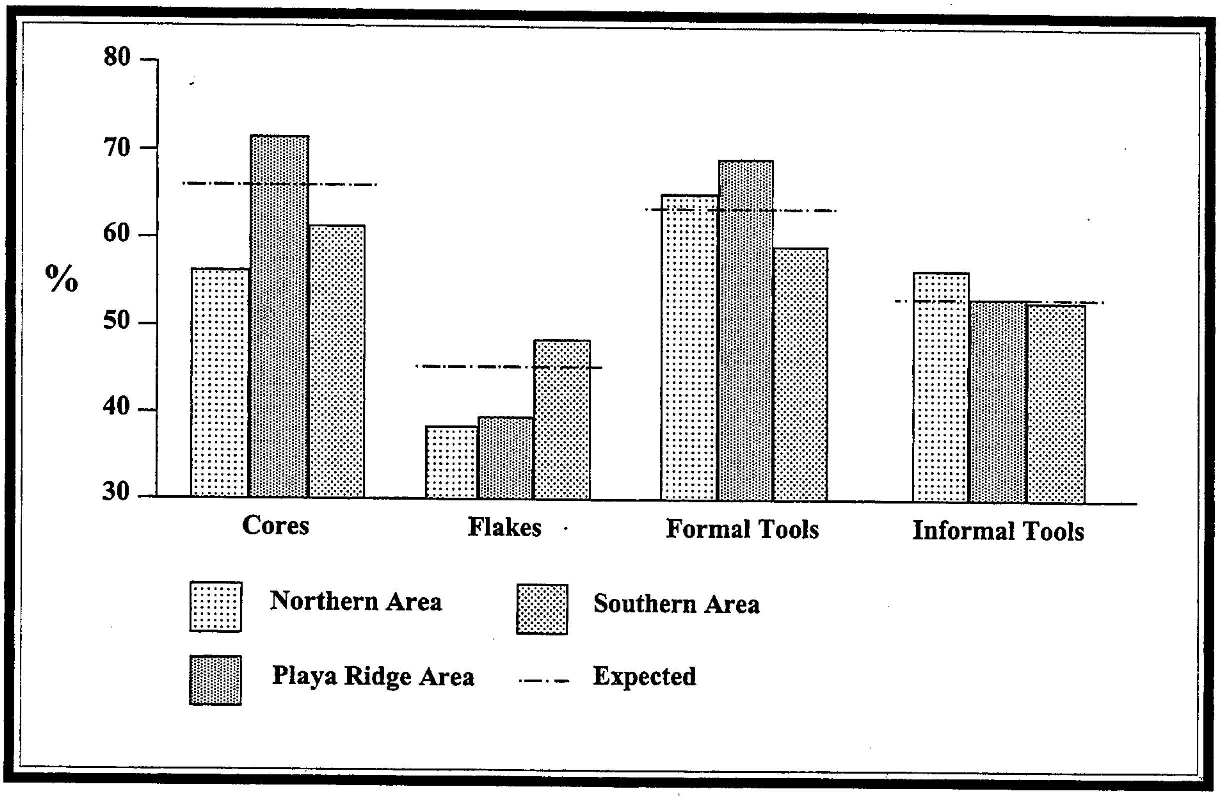

Figure 8.24. Fine-Grained Material Types in Artifact Groups by Area.

In all the comparisons, the playa ridge zone and the southern zone seem to be complementary. Cores, formal tools, and hammerstones are greater than expected along the playa ridge, but less than expected in the remainder of the southern area. Flake debitage is less common along the playa ridge, but more common in the southern area. Cores and formal tools along the playa ridge are more often made of fine-grained material, and the flakes of fine-grained material are less common. The pattern in the south is the opposite. Debitage thickness is more reflective of tool production, but there are fewer formal tools than expected; debitage along the playa ridge is more reflective of flake production, but formal tools are overrepresented.

The factors that account for these difference are not clear; it appears that different conditions may be surrounding the deposition of high quality cores, formal tools, and flake debitage in these two areas. This possibility is especially interesting if the suggestion is valid that formal tools were brought into the area in a completed fashion and many of the cores could probably have been acquired locally. These data suggest that formal and informal tools have different acquisition and depositional histories.

Substantial differences that may indicate different reduction patterns exist in chipped stone material in all clusters relative to materials on sites but not in clusters. The median thickness of medial-distal fragments in all material grouped into clusters is 0.47 ($N = 911$; mean = 0.54). This is significantly smaller than the noncluster medial-distal fragments, which have a median thickness of 0.67 ($N = 161$; mean = 0.81). Flakes without cortex, 49.3 percent of 3,186 specimens, are more common in clusters. This compares to 41.1 percent for the noncluster assemblage. Platform faceting is more common in clusters, accounting for 20.4 percent of the flakes with platforms compared to 16.7 percent of the noncluster material. Finally, cluster assemblages seem to have higher quality materials than noncluster settings, though the differences are not great. Forty-nine percent of the noncluster flakes are of fine and very fine grained materials; 52.6 percent of all cluster material is in the fine and very fine group.

These patterns suggest that the chipped stone assemblage in clusters may represent more formal reduction activities, but two other possibilities should be noted. First, by their very nature, clusters of artifacts may be locations in which considerably

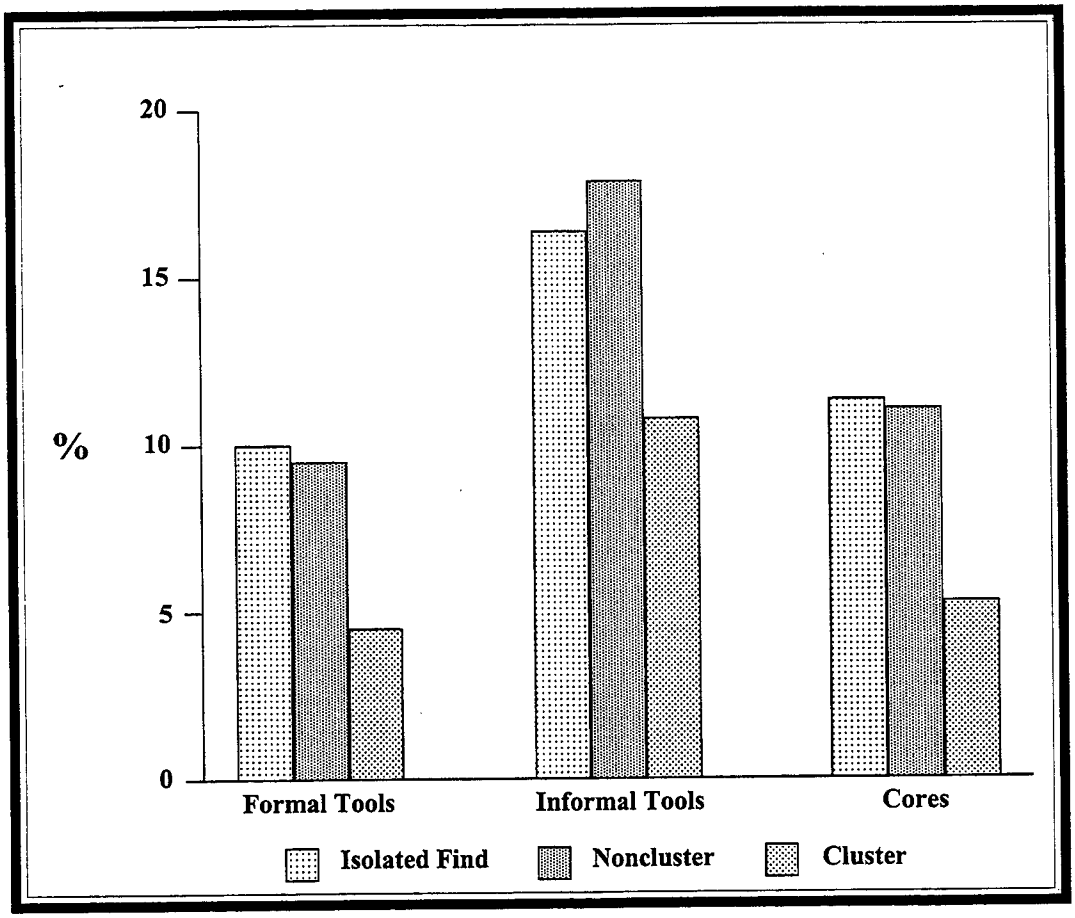

Figure 8.25. Formal Tools, Informal Tools, and Cores in Isolated Find, Non-Cluster, and Cluster Assemblages.

more time is spent looking for material. The greater frequency of small specimens in clusters may be related to a more complete search of the cluster area, which would result in the recovery of smaller specimens, and therefore the characterization as tool production areas. Second, the clusters frequently reflect exposed areas that may be subject to greater erosion, resulting in the deposition of both small and large specimens on a single surface. The nonclustered material may reflect differences between surface and subsurface artifact size distribution. Although neither possibility can be discounted, the data clearly demonstrate that clusters are, in general, different from nonclusters. Whether these differences are the result of more formal tool reduction activities in clusters, of differential search intensity in clusters, or of geomorphic processes remains unclear.

Cluster assemblages of formal tools, informal tools, and core percentages as a group are quite different from nonclusters and isolated finds (Figure 8.25). Tools and cores dominated the materials outside clusters, yet the debitage associated with noncluster assemblages does not seem to reflect an emphasis on formal reduction. These differences, which are further explored in Chapter 12, suggest that the noncluster assemblages may be the result of different processes, possibly indicating different functional or adaptive roles for clusters, nonclusters, and isolated artifacts.

The impact of search procedures and geomorphic processes on the sizes of specimens, and therefore the characteristics of those specimens, may also account for the patterns. Lower percentages of cores and tools in clusters and higher percentages of large specimens in noncluster and isolated settings may simply reflect the more frequent recovery of large specimens such as cores and tools in unexposed settings. Smaller specimens such as debitage are frequently covered by eolian sediments in noncluster and isolated settings and more frequently exposed in

clusters that may, in part, correlate with exposed areas.

Finally, evidence of battering use wear is more frequent on tools in clusters than expected, and feather and step polish is more frequently associated with nonclustered tools (Table 8.12). It is impossible at the present time to attribute a specific activity range to the production of the various edge damage patterns, but the data demonstrate the distinctiveness of cluster and noncluster assemblages. It is unlikely that these differences can be attributed to exposure differences creating different size ranges in cluster and noncluster settings. Tools with rounding or battering damage patterns, which are more frequent in clusters, are, on average, the largest edge damage class (mean = 4.85 centimeters) and the feather and step polishing group is the smallest (mean = 2.93 centimeters). If the sizes of the tools determine cluster and noncluster patterns, clusters should be dominated by smaller tools. That is, the pattern should be opposite of that observed.

Table 8.12. Cluster and Noncluster Edge Damage Patterns.

Edge Damage	Noncluster		Cluster		Total
	Act.	Exp.	Act.	Exp.	Act.
Rounding/battering	20	32	87	75	107
Feather/step rounding	111	109	257	259	368
Feather/step	61	60	40	41	101
Feather/step polishing	57	49	107	115	164
Total	249	250	491	490	740

Act. = actual number
Exp. = expected number

Summary

Analyses of chipped stone materials suggest several patterns relevant to understanding temporal, adaptive, and functional contexts. The differences in the use of higher quality raw materials may reflect temporal and mobility differences, with mobile groups using higher quality raw materials. A variety of attributes have been suggested to reflect Archaic occupations, including the presence of higher quality raw materials (Carmichael 1986; Thompson and Beckett 1979; Whalen 1980). However, patterns revealed by analyses suggest that attempts to relate specific raw materials to specific sources as an indication of mobility or as a guide to temporal placement are not straightforward.

Raw material acquisition in the present project area appears to have been by natural availability, scavenging, and perhaps the tool type itself. Materials such as obsidian, chalcedony, and a high percentage of the miscellaneous chert may be from local gravels. Many of the remaining materials probably represent recycling or reuse of ground stone rather than a primary acquisition strategy. A distinction between formal (retouched) and informal (utilized flakes and debitage) tools suggests that differing acquisition strategies may be involved within certain raw material types. Differences at the landform level further support these patterns within the project boundaries. Patterns in tool types, cores, and debitage suggest that the factors responsible for the deposition of production debitage may be different from, or occur at a radically different frequency than the factors responsible for the deposition of formal tools and cores. The lack of understanding of acquisition strategies and depositional processes makes attempts to use these patterns for temporal placement of some portion of the occupation, or to assess variations in mobility patterns, seem unwise. This may be the result of the availability of gravels in the project area, as well as the availability of previously deposited artifacts on the landscape, but the pattern of gravels in the project area does not appear to be different from the rest of the central basin.

Analyses of edge angle and edge damage patterns on a variety of morphologically distinct tool types suggest that a wide variety of activities were conducted in the project area. Although specific activity patterns cannot be identified, a possible association between smaller, fine-grained tools with a feather and step polish use wear and animal processing is suggested.

Variability within the project area suggests that different factors may account for the deposition of high quality cores, formal tools, and flake debitage along the playa ridge, and that there are substantial differences between cluster and noncluster assemblages. It is unclear exactly what factors can explain these differences, but the data indicate that different areas within the project may have different histories of use and patterns of deposition.

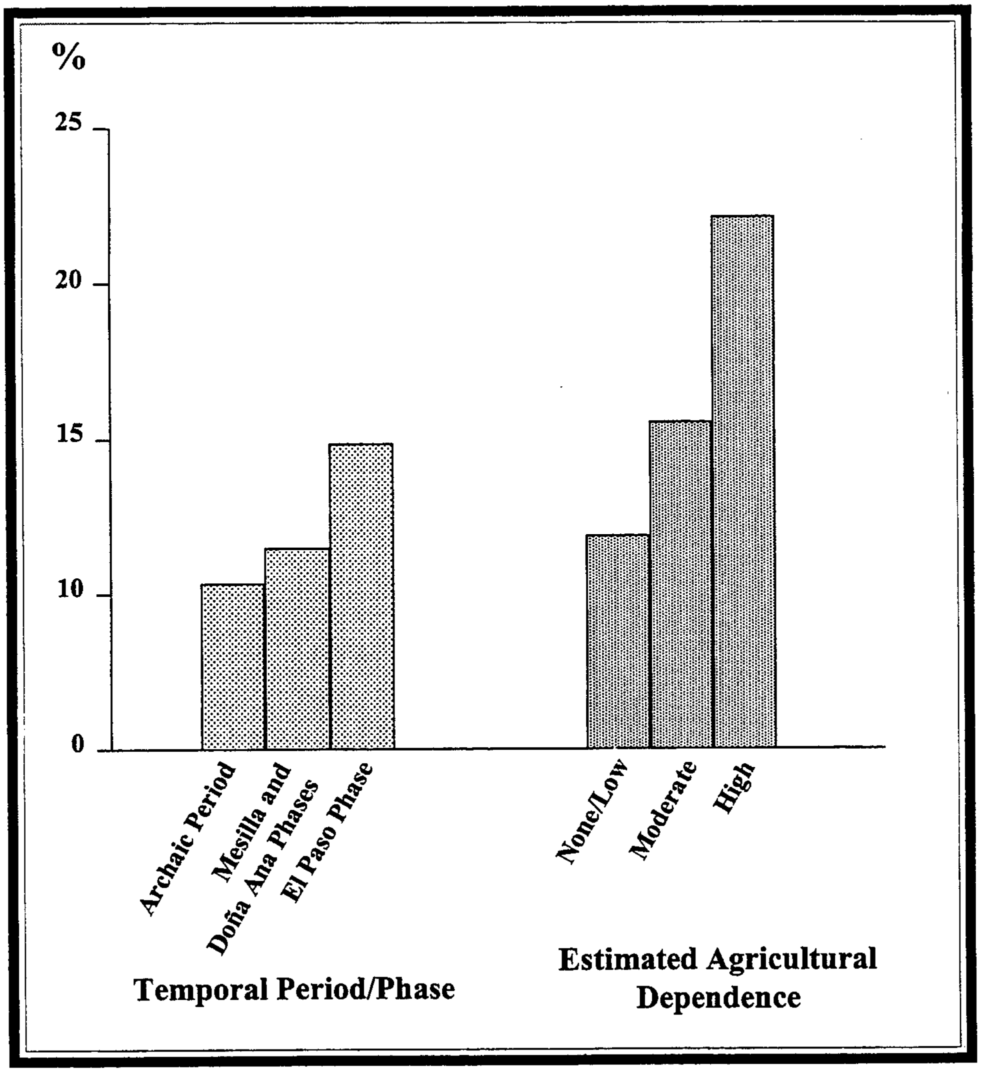

Figure 8.26. Average Mano Lengths by Period/Phase (Calamia 1983) and Estimated Agricultural Dependence (Hard 1990).

Ground Stone

A variety of distinctions made within the ground stone tool class included the type of grinding implement (mano, metate, anvil, pestle), specimen size, grinding area size, and type of stone. The principal analysis focus was on changes in the grinding surface area as a measure of the importance of agriculture relative to wild seed processing in sites (Hard 1986; Lancaster 1983; Mauldin 1993b; Mauldin and Tomka 1989). That focus assumed a moderate number of ground stone specimens would be complete or of sufficient size to estimate the grinding surface area. Unfortunately, this was not the case; of the 1,933 ground stone specimens recovered in the project, over 98 percent are too fragmentary to estimate the grinding surface area or original size. Most ground stone tools had secondary use, with over 97 percent being fire cracked. Only 16 of the ground stone pieces did not have a secondary use.

The fragmentary nature of the assemblage is further reflected by its size. The average maximum length is less than 5 centimeters, with 75 percent of the assemblage being below 6 centimeters.

Lengths and widths of ground surfaces were estimated on 20 manos that are more than 50 percent complete. The average grinding length is 7.8 centimeters, with the maximum length of 12.1 centime-

ters. The average grinding surface width is 5.7 centimeters, with a maximum of 9.8 centimeters. Those that are sufficiently complete to estimate the grinding surface area are classified as one-handed manos. This size range is common among hunter-gatherer groups that have little or no agriculture.

Though most of the assemblage is fragmentary, it was possible to make gross distinctions between manos and metate fragments on roughly 53 percent of the specimens. Manos account for 33 percent of the identifiable ground stone; 652 specimens (64 percent) have metate attributes, and 33 (3 percent) have attributes of both mano and metate fragments. Finally, several pestle fragments and one possible palette fragment were recovered. The predominance of metates is probably a function of the larger initial size of this tool type rather than any direct reflection of the importance of metates in the assemblage.

A variety of coarse-grained materials are represented in the ground stone on the project (Table 8.13). Three material groups, quartzite, miscellaneous coarse-grained materials, and basalt, account for the vast majority of specimens with a ground surface. Of the three major types, quartzite and basalt were more common in metates, with roughly 23 percent of the identifiable specimens of each type being manos and 72 percent being metates. Manos in the miscellaneous coarse-grained materials category represent 42 percent of the assemblage. The surprising element is the large number of quartzite metates. Quartzite often occurs along the alluvial fans in nodules that appear to be unsuited for metates. This may represent a problem with the material classification or the distinction is in identification of raw materials that are not the more common quartzite nodules.

Table 8.13. Ground Stone Material Types.

Material	#	%
Basalt	501	25.9
Franklin rhyolite	55	2.8
Miscellaneous granular	614	31.8
Organ rhyolite	26	1.3
Quartzite	731	37.8
Silicified limestone/sandstone	6	0.3
Total	1,933	99.9

Ground stone analysis also included recording the number of used surfaces on project specimens. Adams (1993), working with data from northern Arizona, found that multiple grinding surfaces are more common on manos in assemblages where grinding is intensive. She argues that this is a result of an attempt to conserve raw material by altering the use surfaces under conditions of intensive grinding. The number of multiple-sided ground stone specimens in the Project 90-11 area suggests that the intensity of grinding was moderate, as 24 percent of the manos had more than one ground surface. These data may suggest that grinding activities were relatively intensive in the project area. However, grinding surface area data suggest a focus on smaller, one-handed manos, which are usually associated with low intensity grinding. A pattern identified by the number of sides on manos may be a direct reflection of raw material scarcity in the project area rather than an indirect consequence of a high frequency of grinding resulting in raw material stress.

The relationship between grinding surface lengths on manos and agricultural dependence is grounded in processing rates (Figure 8.26) and has been discussed by several authors (Bartlett 1933; Hard 1986, 1990; Lancaster 1983; Mauldin 1993b; Mauldin and Tomka 1989). Regional data suggest that the relatively small length of manos is not uncommon during most of the prehistoric sequence in the El Paso area, and that only during the later time periods did agriculture increase to a point of moderate dependence. Assemblage sizes in the project area indicate little or no agriculture being practiced at these locations.

Small grinding areas suggest a dependence on wild plant foods rather than a focus on agricultural grain processing. The moderate frequency of multiple-sided specimens in the Project 90-11 area is probably related more to raw material stress than processing intensity as such. The assemblage was frequently reused, ultimately ending up as hearthstones or as chipped stone.

Summary and Conclusions

A variety of analytical techniques used to determine variability in lithic assemblages included a geological survey of materials in gravel deposits in the project area that identified a wide variety of potentially usable stone tool material. Using these data as a baseline, patterns of raw material use, tool and material relationships, and reduction patterns were examined. Within the tool category itself, low-level use-wear analysis, edge angle attributes, and overall tool size were studied.

The ground stone analysis was severely limited by the fragmentary nature of the collection as only a few complete specimens are available. Much of the ground stone has been reused in a variety of contexts, with most ending up as fire-cracked rock.

The results of various analyses suggest a strong relationship between raw material characteristics and uses. High quality cryptocrystalline materials, which tend to occur in smaller size ranges, were frequently used for formal tool production. Conversely, coarse-grained specimens were frequently employed for ground stones and hammerstones, and may have been associated with activities that required a stronger or more durable tool.

Various combinations of size and cortex patterns in debitage and cores suggest that obsidian, chalcedony, and a high percentage of the miscellaneous chert from the assemblage may have been procured from gravels within the project area. In addition, many of the remaining materials resulting from chipped stone production probably represent recycling or reuse of ground stone, rather than a primary acquisition strategy. It is possible that differing acquisition strategies may have been involved for formal (retouched) and informal (utilized flakes and debitage) tools within certain raw material types. Informal tools of obsidian, chalcedony, and all cherts may have been locally acquired, and the formal tools of chalcedony and chert may have been brought into the project area. These patterns greatly complicate any attempt to relate specific materials to specific sources and demonstrate the complicated nature of raw material acquisition.

At the project level, edge damage and edge angle studies on tools suggest a variety of activities. Analysis of the ground stone data suggests a focus on nonagricultural grains. Chipped stone materials in clusters are considerably different from those outside clusters, and different landforms in the project area may have different patterns of use and discard.

Information provided by chipped and ground stone analyses are most directly applicable to questions of activities or functions. Any investigation of temporal or adaptive changes in assemblages, such as investigating mobility differences through raw material acquisition or identifying Archaic period assemblages based on raw material quality and tool types, is extremely difficult because acquisition strategies and depositional rates are highly variable, and may be different for formal and informal tools. Reuse and scavenging appear to have been frequent, with most specimens having multiple uses. The spatial and temporal scales at which comparisons can be made is unclear.

Chapter 9

FEATURES

This chapter describes the results of surface observations and excavations of features in the project area. The primary interests are identification of patterns that may indicate activities associated with feature types and patterns within feature classes. No clear-cut distinctions are possible, but a number of relationships are suggested.

Detailed surface observations made on 790 features included identifying the type of feature, estimating the number and size range of associated hearthstones, and counting artifacts within the feature or immediate area. Surface data were used to document the effects of erosion and/or military traffic on features. The data suggest that features associated with fire-cracked rock have a higher frequency of associated lithics than features without fire-cracked rock or with burned caliche.

During Phases 2 and 3 of the project 308 features were excavated. Data on feature type, hearthstone size and weight, and related artifacts suggest an association between the number and weight of hearthstones and the recovery of artifacts. It is impossible to discount the complications of erosion but changes in the frequency of fire-cracked rock and burned caliche suggest that the pattern may be one of reuse rather than the result of erosion.

The results of several experimental studies document the effects of adding rock and caliche to features. The primary advantage seems to be related to heat retention. Heat retention would have been useful for situations involving plant processing, though additional situations can be envisioned where heat storage may have been advantageous. However, any clear-cut association between either plant use and other uses associated with the addition of stone remains unknown.

Surface Features

Attributes of 790 surface features on the project were recorded. The original interest was in identifying specific feature types that may have been used for certain sets of activities. However, most of the patterns in surface features appear to be related to exposure. These data document the significant impact that exposure has on the quality of the data available for analysis.

Features were recorded using the standard Fort Bliss definitions: burned caliche without stain, burned caliche with stain, fire-cracked rock without caliche or stain, fire-cracked rock with stain, burned caliche and fire-cracked rock with stain, burned caliche and fire-cracked rock without stain, stain less than 1 meter, and stain larger than 1 meter. For analysis purposes feature types were combined into the following feature categories:

- Fire-cracked rock with and without stains (FCR)
- Large and small stains without rock (stains)
- Burned caliche with and without stains (BC)
- Burned caliche and fire-cracked rock with and without stains (BC/FCR)

Burned caliche features made up the largest category, accounting for 355 (45 percent). Burned caliche/fire-cracked rock features comprised 277 (35 percent), and stains accounted for 134 features (17 percent). Fire-cracked rock features were relatively scarce accounting for only 24 examples (3 percent). Limestone was relatively common in the latter group, but quartzite, rhyolite, basalt, and miscellaneous coarse-grained materials also were represented. The latter materials often were ground stone fragments or other artifact types.

The number of artifacts exposed in the feature and the quantities of hearthstones were estimated using ordinal categories. Of the features with hearthstones, the majority (53 percent) had less than 15 visible on the surface. Features with more than 100 visible stones accounted for about 3.5 percent of the 656 burned caliche/fire-cracked rock features.

Exposure and Patterns in Hearthstone Attributes

As with site boundaries and recovery rates, exposure patterns affected the quality of feature data. Stains were more common in exposed settings than in

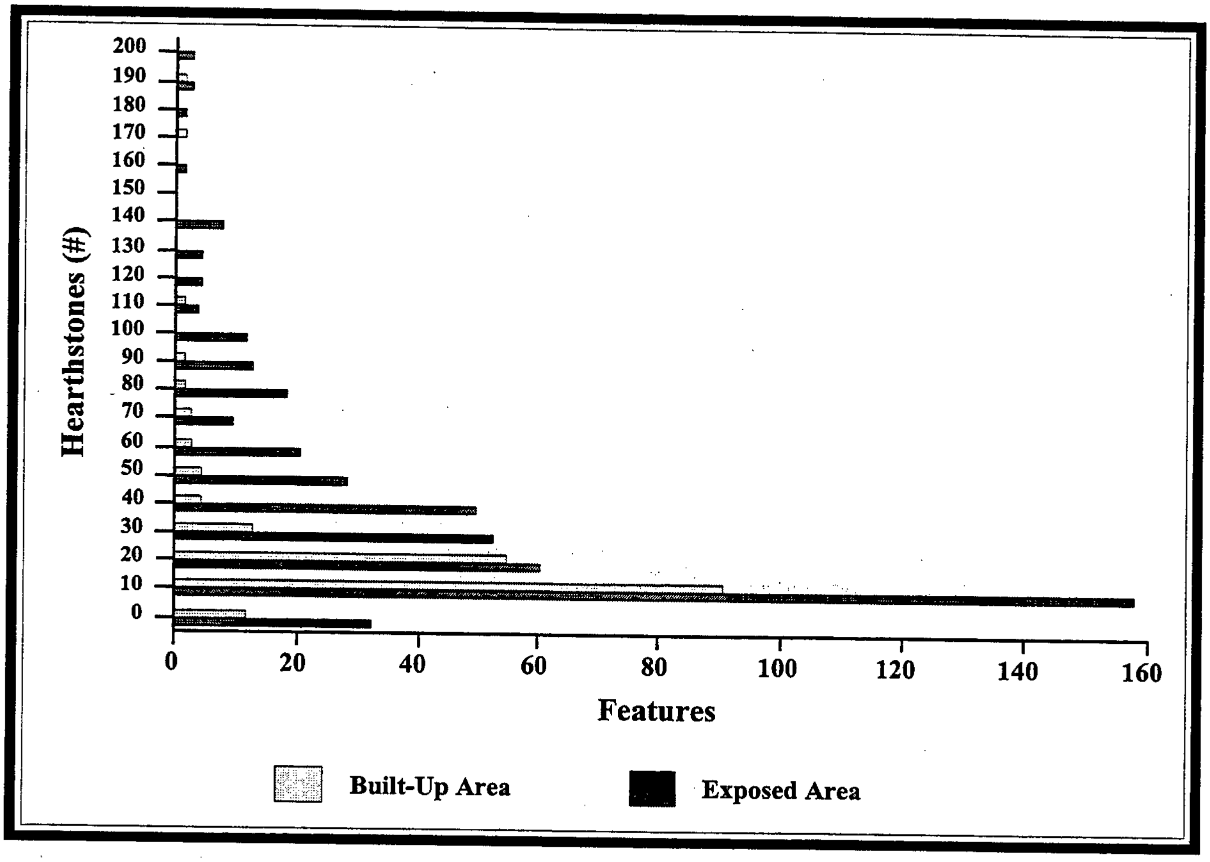

Figure 9.1. Fire-Cracked Rock Estimates by Exposure, Surface Features.

built-up areas, which was expected because they were more likely to have been undergoing erosion. Exposure also affected the quality of features with hearthstones. The exposed areas of the project contained 472 hearthstone features with an average of 35.8 stones (median = 24). Conversely, the 184 features with hearthstones in built-up areas had an average count of 21.3 stones per feature (median = 15). Thus, there are significantly more stones on features in exposed settings (Figure 9.1).

This pattern might be a matter of visibility: as features are increasingly uncovered by erosion, more hearthstones are exposed on the surface. However, when the estimated weights of hearthstones—estimates derived from counts and size data in combination with actual weights on over 2,000 hearthstones—were compared by feature type, features in built-up areas tended to have significantly greater weight even though there were fewer items. The estimated average weight for features in exposed areas is 331 grams and the average weight for features in the built-up areas is 675 grams, suggesting that hearthstones in the built-up areas are significantly larger and exposure seems to be correlated with more and significantly smaller stone. This may be a result of the exposure of hearthstones to environmental factors and the increasing impact of military traffic on features in exposed settings. Tracks from military use are ubiquitous in the project area and the heaviest incidences often occur through interdunal areas, which are classified as exposed in the project's erosional scheme. Not surprisingly, tanks have a significant impact on breaking and probably in dispersing hearthstones.

Artifact Associations

Analysis of the number of artifacts within features suggests an association between (a) those with burned caliche and other fire-cracked rocks and lithics and (b) ground stone and all fire-cracked rock feature types (Table 9.1). The latter association simply represents the frequent reuse of ground stone as hearthstones in features. The former association may reflect some activity differences between features, although most features lacked artifacts.

Table 9.1. Feature Types and Artifact Associations.

Feature Type	# of Features	Lithics #	Lithics Avg. per feature	Ceramics #	Ceramics Avg. per feature	Ground Stone #	Ground Stone Avg. per feature	% without Artifacts	% without Lithics or Ceramics
Burned caliche	322	109	0.34	8	0.03	16	0.05	80	82
Burned caliche w/stain	33	6	0.18	13	0.39	0	0.00	85	85
Burned caliche and fire-cracked rock	254	242	0.95	20	0.08	796	3.13	26	61
Burned caliche and fire-cracked rock w/stain	28	28	1.22	7	0.30	36	1.57	30	65
Fire-cracked rock	22	13	0.59	0	0.00	130	5.91	27	68
Small stain	133	19	0.14	2	0.02	5	0.04	91	91

Note: Fire-cracked rock with stain and large stains are not included because only three examples were identified.

Features had a slightly higher frequency of artifacts in exposed areas of the project. The 586 features in exposed areas had an average number of 2.03; the 204 features in built-up areas had a mean of 1.32 artifacts.

Surface feature patterns indicate that exposure affects the number and size of hearthstones in features, as well as the presence of stains and the number of artifacts recovered. There seems to be a weak association between lithic artifacts and features with both fire-cracked rocks and burned caliche, but most features lack any artifacts.

Excavated Features

A total of 308 features was excavated during the project (see Chapter 6 for feature descriptions), and 269 prehistoric thermal features were analyzed. Probable structures, features within structures, and features that were thought to be modern based on the recovery of modern trash are not considered here.

Basin shapes accounted for about 75 percent of the features for which cross sections could be discerned. Shallow lenses made up 13 percent of the feature cross sections; cylindrical (6 percent) and amorphous shapes (6 percent) also were recorded. Circular surface shapes were most common, accounting for about 56 percent of the features on which shape could be identified. Oval plan view shapes also were common, making up 31 percent, and 13 percent were classified as amorphous.

Artifact and Stone Hearth Relationships

Testing and excavation of relatively large areas around features often revealed other features within a few meters. These were frequently eroded and often impacted by vehicular traffic, which made identification of associated artifacts, faunal remains, and even hearthstones, problematic. Efforts were made to examine associations between artifacts and feature types, as well as relationships between quantity and size of fire-cracked rocks and/or burned caliche, and patterns in faunal remains that might indicate feature functions. To do so it was necessary to assign material to specific features and identify a common unit of space that defined the associations.

After researching ethnographic sources (for example, Binford 1983; Nicholson and Cane 1991) and analyzing actual artifact distributions in the excavated sample, approximately 13 square meters per hearth was determined to be a practical spatial scale for comparison purposes (Figure 9.2). The arbitrary distance was roughly equivalent to a 2-meter radius around a feature. For a given feature, the 1-by-1-meter square that contained a stain or pit—or the highest number of fire-cracked rocks and/or burned caliche if no pit was present—was identified. All material within the 12 square meters that surrounded the central meter was selected. When feature areas overlapped or were within 2 to 3 meters of each other, artifacts and/or hearthstones were tallied with

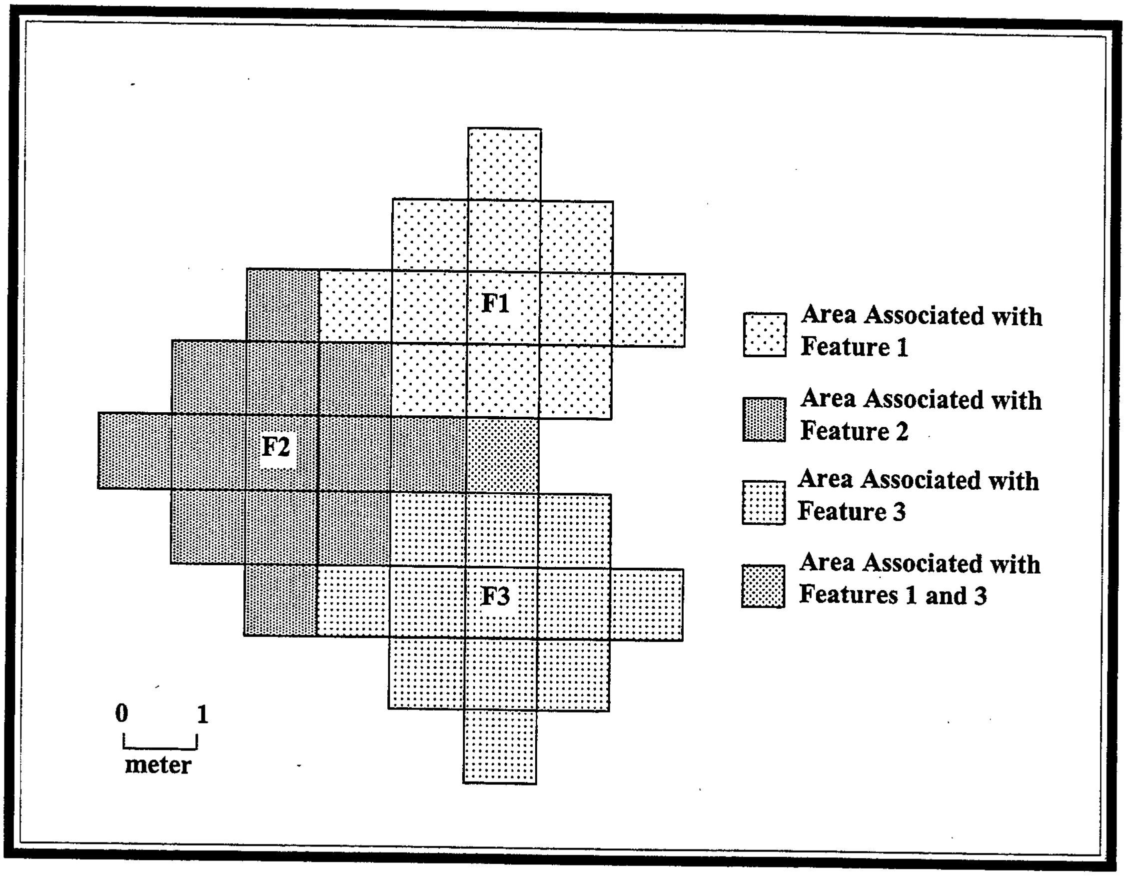

Figure 9.2. Assignment of Artifacts and Hearthstones to Given Features. Each feature is associated with 13 square meters, an area that approximates a 4-meter circle.

each feature and counted more than once. Results of excavations around features indicate that the 13-square-meter unit maximized the amount of space, and consequently material, that could be associated with a feature. At the same time the significant overlap between distributions was minimized.

Fire-Cracked Rock/Burned Caliche Patterns

Each piece of burned caliche and/or fire-cracked rock in a given 1-by-1-meter area was counted and measured. There was a substantial increase in the number of fire-cracked rocks and/or burned caliche associated with excavated features when compared to surface totals; however, more than 40 percent had fewer than 75 hearthstones. There appear to be three modalities: one between 525 and 675 stones, one at 725 and 825, and several features with more than 975 (Figure 9.3).

Because the amount of stone in features might be a clue to function, and as the stone varied dramatically in size, its weight in features was estimated. Using size and count data, over 2,000 burned caliche pieces in various size ranges were weighed to determine mean weights for given size ranges and to estimate the hearthstone weight of a feature. The mean weights provided good estimates in the lower size ranges (less than 5 to 7.5 centimeters), which had more than 200 specimens in each category (Table 9.2). However, in the upper size where few hearthstones were measured and the size range was open ended (more than 7.5 centimeters), the estimates were likely to be increasingly inaccurate. Note also that only burned caliche was measured and weighed to provide the data in Table 9.2. Caliche comprised most of the hearthstones; however fire-cracked rock material, which was common in several features, is considerably denser than caliche. Therefore, when these materials comprise a significant portion of the

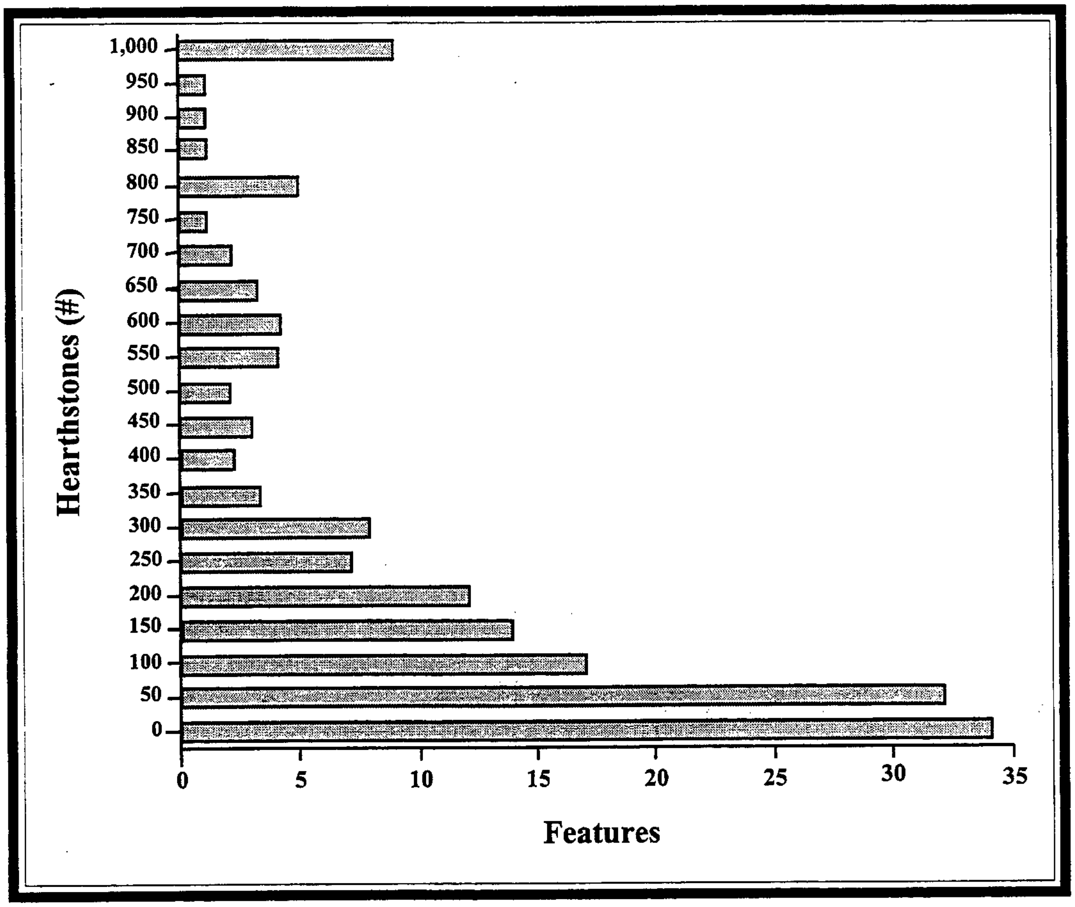

Figure 9.3. Features with Hearthstones.

feature, the true weight will be underrepresented in these estimates.

Table 9.2. Burned Caliche Weight.

Size	#	Mean Weight (gr)
More than 7.6 cm (3 in.)	8	304
5.1–7.5 cm (2–3 in.)	43	148
2.5–5.0 cm (1–2 in.)	242	31
1.3–2.4 cm (0.5–1 in.)	609	4
Less than 1.3 cm (0.5 in.)	1,117	1
Total	2,019	

A wide range exists in estimated weights but most features (54 percent) were below 1,500 grams and 30 percent were below 500 grams (Figure 9.4). A modality is indicated for weights between 7,500 and 8,500 grams.

Differences in weights by feature type were examined for burned caliche, fire-cracked rock, and burned caliche/fire-cracked rock features (Table 9.3). Mean weights are similar, but those with fire-cracked rock and burned caliche appear, based on the median and quartile points, to have significantly greater weight.

Examination of weight distribution for each of the feature types revealed that only those with burned caliche had any patterns hinting at modality (Figure 9.5). There is some indication of modality around 8,000 grams, the same modality that appears in the total feature weights. It is not known if this indicates a different feature type, but the association primarily with burned caliche features is intriguing and suggests that different weight modes may indicate different activities or resource processing.

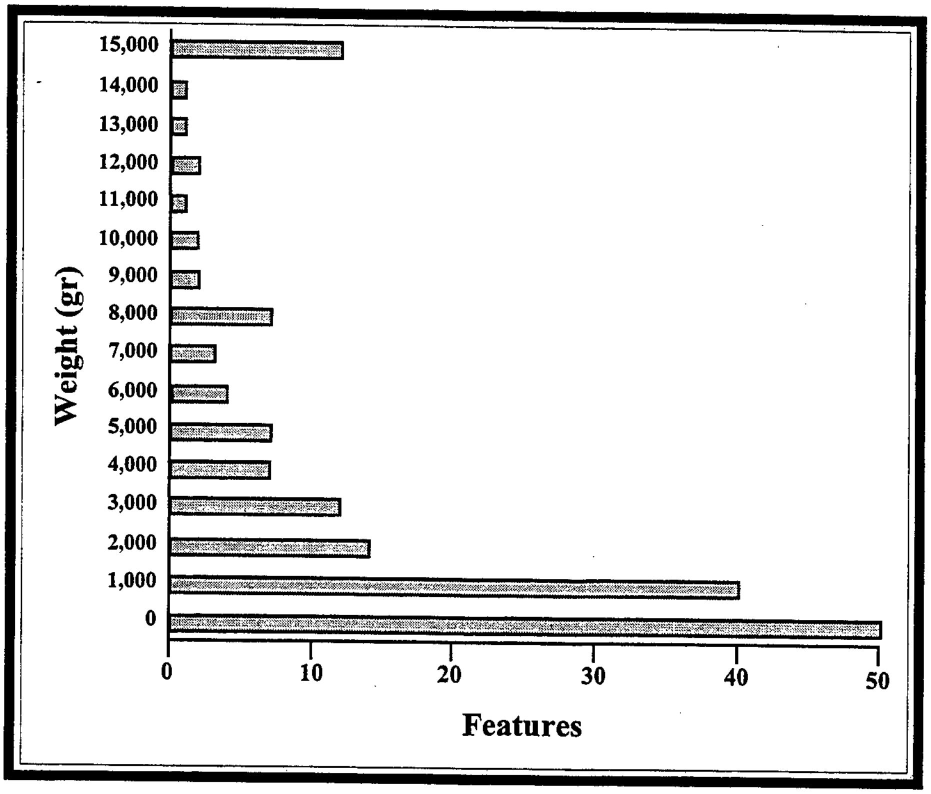

Figure 9.4. Hearthstone Feature Weights.

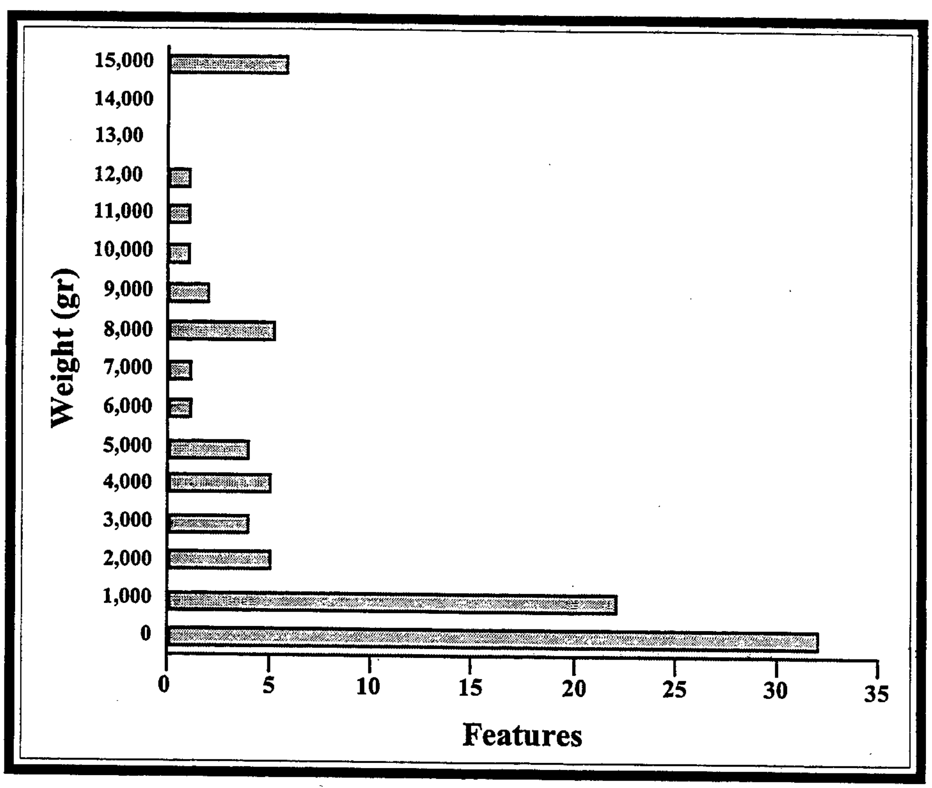

Figure 9.5. Burned Caliche Feature Weights.

Table 9.3. Excavated Feature Weights.

Feature Type	Number	Mean (gr)	Lower Quartile (gr)	Median (gr)	Upper Quartile (gr)	Maximum (gr)
Burned caliche	90	4,066	299	862	4,438	52,305
Fire-cracked rock	13	3,511	228	436	2,118	20,779
Burned caliche and fire-cracked rock	62	4,063	773	2,049	5,386	28,519
Total	165					

Feature Types and Faunal Associations

Relationships between feature types and the presence of burned bone were studied to find patterns that identified activities associated with the feature types. Identification of faunal material is discussed in Appendix I. Similar studies with floral remains were planned but low recovery rates precluded the investigation.

Burned bone rather than all bone was the focus of the faunal study because of the possibility that a portion of the remains may have been intrusive and thus unrelated to feature use. Burned bone also has a high probability of reflecting subsistence remains. Because the primary concern was with thermal features, specimens from houses were eliminated from consideration.

Table 9.4 summarizes the presence or absence of burned bone by feature type. The only potential difference between the expected numbers (based on a standard predictive model) is a slight increase in burned remains associated with stains; 13 were expected compared to the 18 actual cases. A slight decrease in the presence of burned remains was associated with burned caliche features (expected 10, actual 3). The pattern is certainly not strong.

Table 9.4. Burned Bone in Features.

Feature Type	Absent	Present	Total
Burned caliche	87	3	90
Fire-cracked rock	10	3	13
Fire-cracked rock with burned caliche	54	7	61
Stains	101	18	119
Total	252	31	283

To explore possible relationships between the presence of stains and the recovery of bone, the presence or absence of bone relative to feature volume greater than zero was examined. Pits with burned bone had a significantly greater volume than those that lacked bone. The 24 features with bone had an average volume of 87.9 liters (median 31), and the 151 features without bone had an average volume of 33.8 liters (median 10.4).

This association of burned bone with features of larger volume may be interpreted as a functional relationship; however, it is more likely to represent a preservation bias—as features are exposed and begin to erode, faunal material is exposed on the surface. The rate at which exposed bone deteriorates in an arid environment is not known but the association between artifact presence or absence and pit volume suggests that the relationship between bone and feature volume may be one of exposure (Figure 9.6). Artifacts, being primarily lithics, should not be significantly impacted by erosion, and the lack of pattern further strengthens the suggestion that the greater recovery of bone in features with greater volume is related to exposure. However, there is no compelling reason to link the recovery of artifacts with the recovery of bone—bone and artifacts probably do have different patterns of deposition. So, although the relationship between the presence of burned bone and stains may be the result of exposure, the possibility remains that some functional relationship exists.

Feature Types and Artifact Associations

The number of artifact types associated with feature types was analyzed to identify patterns among artifacts and feature types that may relate to use of particular feature types; modern stains and features inside houses were eliminated from these calculations, also. As with the surface materials, most features lacked associated artifacts and all patterns were subject to the compounding effects of erosion.

Fire-cracked rock features were divided into those with stains visible on the surface and those without visible stains. Similar distinctions were made

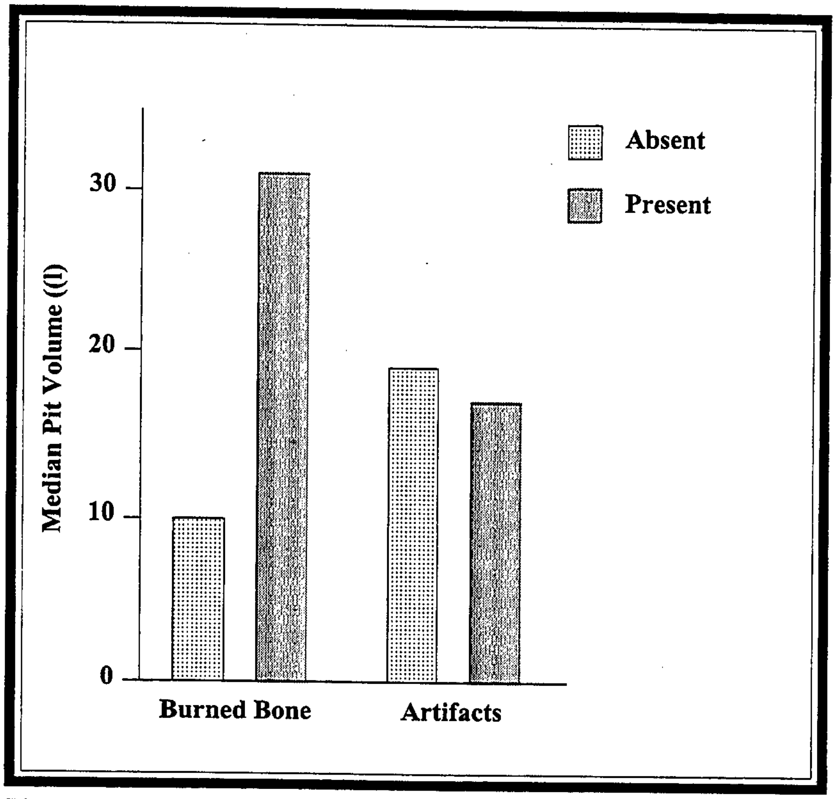

Figure 9.6. Feature Pit Volume and Recovery of Burned Bone and Artifacts.

for burned caliche/fire-cracked rock and fire-cracked rock features. The presence of stains in a feature was not expected to affect artifact recovery because it was primarily thought to be related to exposure. Features lacking stains were thought to be of the same class as those with stains with the former simply being eroded.

With the exception of differences between fire-cracked rock features with and without stains a difference almost certainly related to the small number (*N* = 2) without stains excavated, there was no substantial difference within a given feature type (Table 9.5). Burned caliche features with stains average 4.1 artifacts per feature and those without stains averaged 3.1. Given the low frequency of artifacts in general, and that about 25 percent of the burned caliche features lacked any artifacts, this difference is probably insignificant. There was no difference between artifact totals and the presence or absence of stains in burned caliche/fire-cracked rock features; in fact, those without stains were slightly more likely to contain artifacts.

Table 9.5. Artifact Recovery around Feature Types.

Feature Type	**% without Artifacts**	**Average # Artifacts**
Burned caliche	26	3
Burned caliche w/stain	21	4
Burned caliche/fire-cracked rock	14	8
Burned caliche/fire-cracked rock/stain	18	8
Fire-cracked rock	50	1
Fire-cracked rock w/stain	9	8
Stain	27	7

The original expectation about the insignificance of the presence or absence of stains and artifact recovery was supported. All features with hearthstones had similar patterns in numbers of artifacts and were treated as a group for further consideration.

Given the relatively low average occurrence for most artifacts and the high number of features of most types without artifacts, examination of the presence or absence of various feature types and the occurrence of artifact types seemed in order (Table 9.6). Ninety-nine percent of the burned caliche features and 97 percent of the stains did not have hammerstones; 94 percent of both feature types lacked cores. Burned caliche/fire-cracked rock features were associated more frequently with tools than the other feature types. These patterns may hint at functional differences; however, there was no clear pattern because most feature types lacked some artifact class and about 20 percent of features in all classes lacked any artifacts.

Table 9.6. Features with an Artifact Type.

	FCR (%)	BC (%)	BC/FCR (%)	Stain (%)
Artifacts	85	77	84	73
Ceramics	8	8	8	12
Cores	23	6	21	6
Hammerstones	15	1	21	3
Lithics	77	67	79	62
Tools	23	22	40	22

FCR = fire-cracked rock
BC = burned caliche

Burned Caliche/Fire-Cracked Rock Features and Artifact Patterns

The presence or absence of artifact types for all burned caliche/fire-cracked rock features was compared with the quantity of burned caliche and fire-cracked rock in and around the 13-square-meter areas. The data suggest a relationship between the number of burned caliche pieces and fire-cracked rocks and the recovery of some classes of artifacts (Figure 9.7). For example, when cores, hammerstones, and/or lithic debris were present, the median and interquartile ranges for the numbers of burned caliche and fire-cracked rocks were higher than when the tool types were absent. There seems to be little difference in the presence of lithic tools, with quantities being essentially identical. However, burned caliche and fire-cracked rock totals seemed to be somewhat lower when ceramics were present then when they were absent. Lithics seemed to increase as the number of burned caliche and fire-cracked rocks increased, but such a relationship was not present for ceramics. There was a fairly strong relationship between the weight of fire-cracked rock and burned caliche and the total number of artifacts (Figure 9.8) but it is unclear if this was a functional relationship.

The data were divided into five groups: Group 1, features without artifacts; Group 2, 1 to 8 artifacts; Group 3, 9 to 17 artifacts; Group 4, 18 to 30 artifacts; and Group 5, more than 30 artifacts (Figure 9.9). There is a consistent increase in the median and the upper quartile range in the first four groups—as the number of artifacts increases, so does the overall weight of the burned caliche and fire-cracked rock associated with the feature. Group 5, with only three examples, however, does not follow this pattern. Feature 135 on FB6741 (41EP1028), which shows evidence of erosion, is one of these. The other two features were in areas with multiple features that overlapped and may represent false associations. This group of three features simply may represent situations where the high artifact totals were a result of reoccupation and erosion rather than any real association. Discounting this group, the pattern was fairly consistent, with more artifacts being associated with more burned caliche and fire-cracked rock. The burned caliche and fire-cracked rock totals also increased as the number of artifacts increased. Different associations may represent different functional considerations, although the comparable increase in fire-cracked rock and burned caliche feature weights and artifacts suggests some relationship to increasing intensity of occupation and/or reuse.

An additional source of information on the artifact group and fire-cracked rock relationship came from fire-cracked rock and burned caliche size data. Experiments were conducted to get a better understanding of the use of hearthstones in features, with one aspect being an attempt to identify reuse patterns (See Appendix J). The effects of refiring on the size of burned caliche in experimental features were monitored to learn whether total weight would remain roughly equivalent under conditions of reuse while numbers and sizes of caliche pieces would be reduced during refiring as the larger ones were broken up. Initial sizes were measured and sorted into four size classes. Changes in the numbers of items in each size class were monitored with each firing.

There was some relationship between the number of firings and the size distribution patterns in the experimental features (Figure 9.10). With increased firing time, the percentage of fire-cracked rock and burned caliche in the largest size class was

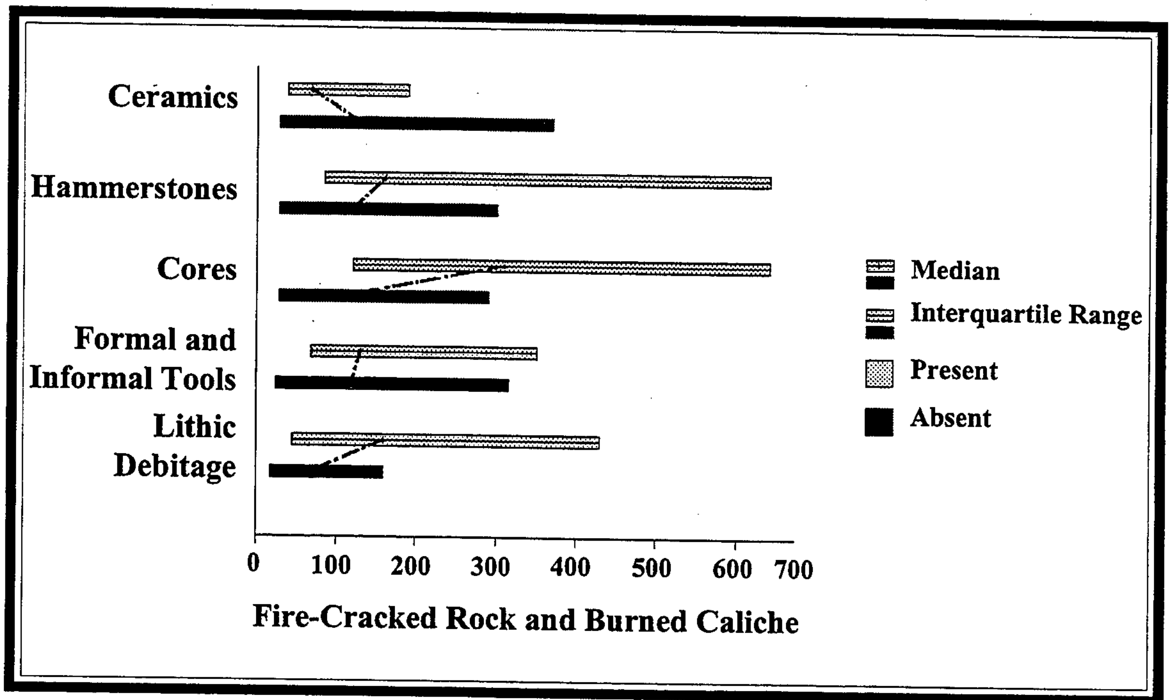

Figure 9.7. Interquartile Ranges of Presence or Absence of Artifact Types and Fire-Cracked Rock/Burned Caliche around Features.

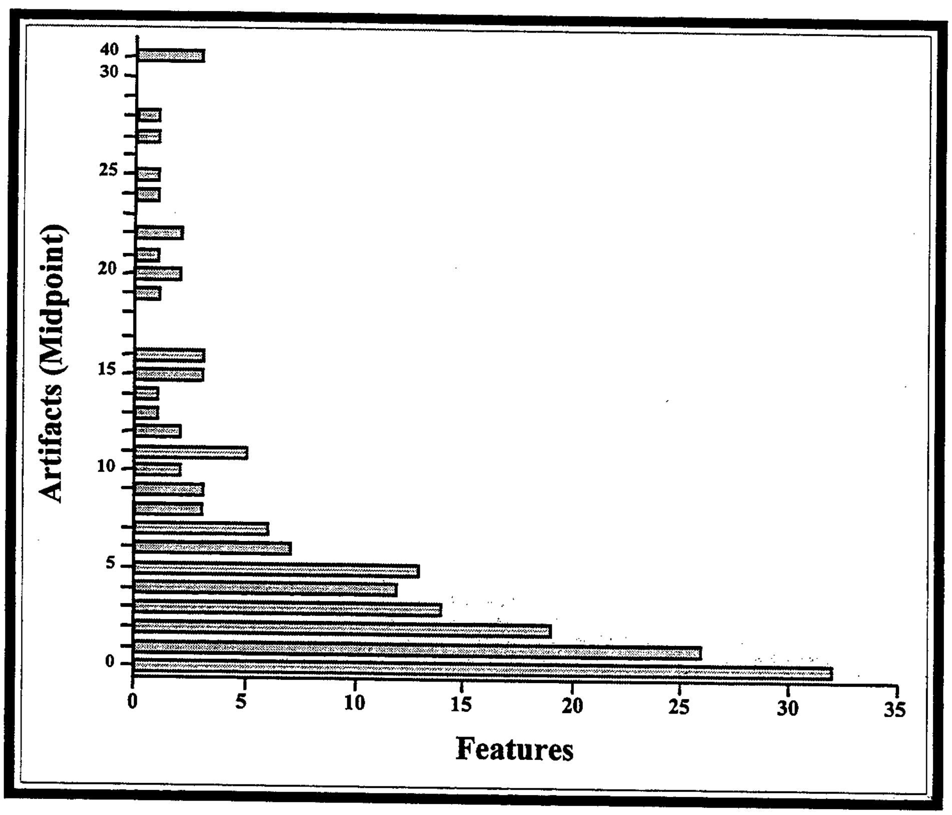

Figure 9.8. Artifact Totals around Fire-Cracked Rock/Burned Caliche Features.

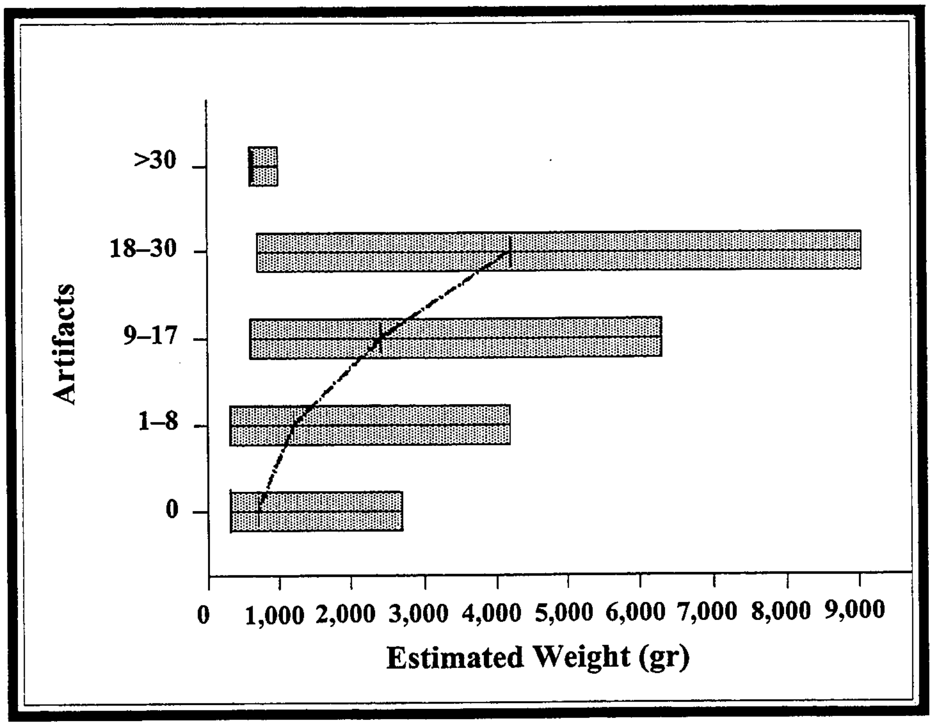

Figure 9.9. Interquartile Range of Estimated Weight, Burned Caliche/Fire-Cracked Rock for Feature and Artifact Groups.

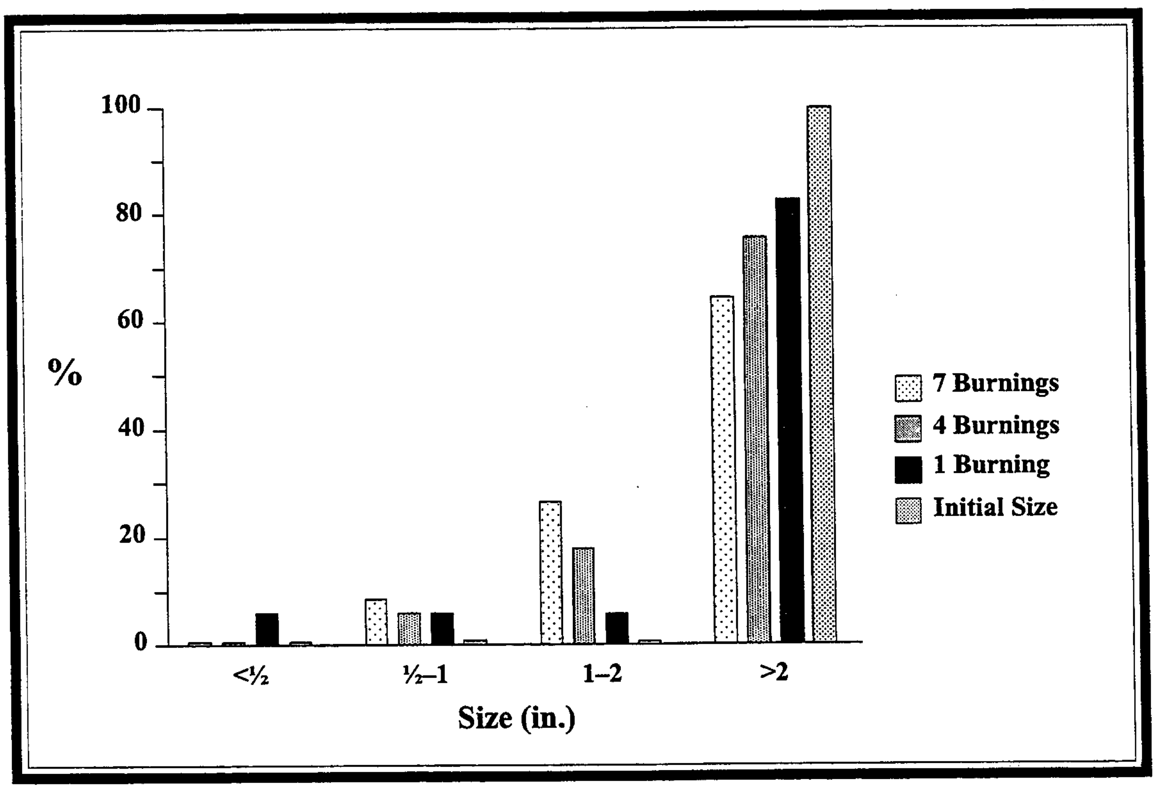

Figure 9.10. Changes in Caliche Size Classes with Reuse.

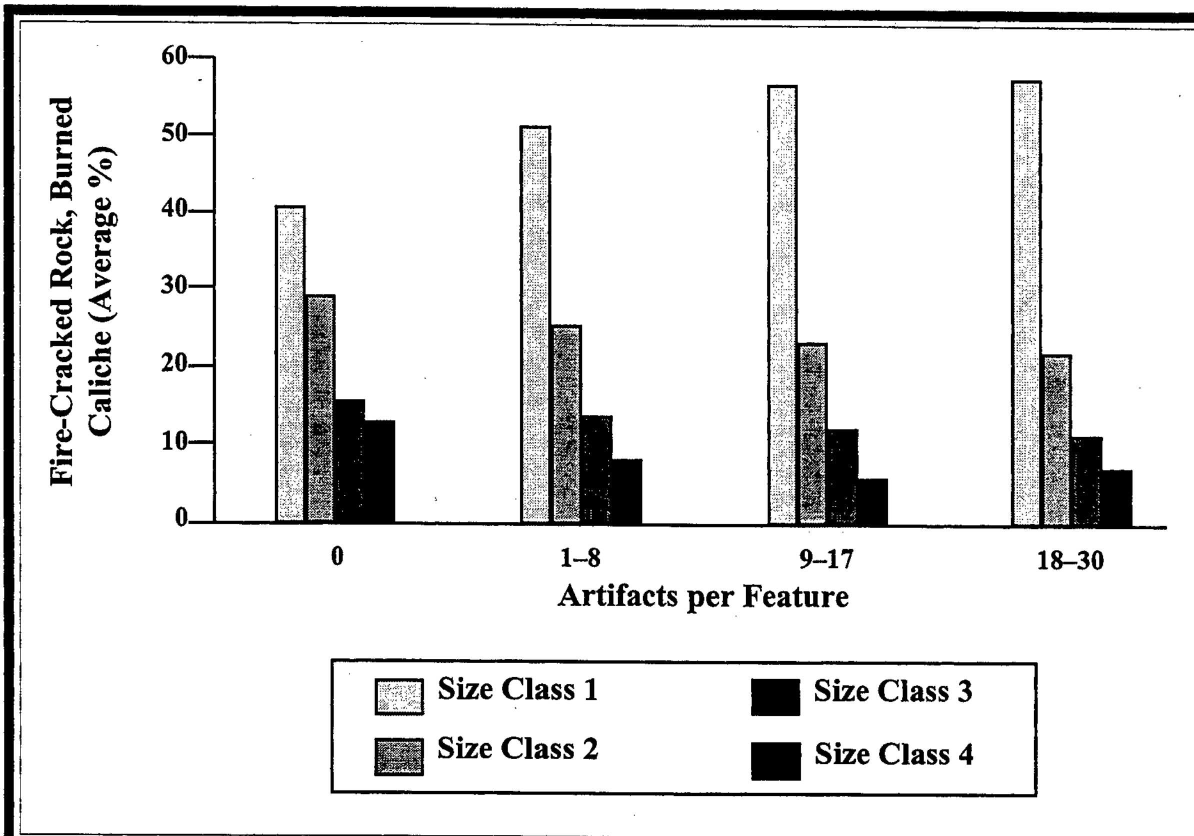

Figure 9.11. Comparisons of Feature/Artifact Group Average Percentages with Fire-Cracked Rock/Burned Caliche Sizes.

reduced. The experimental distributions did not match the archeological patterns, which were dominated by small items, probably as a result of exposure and military impact that further reduced the number of items in the larger size ranges. Although the experimental patterns were considerably different from the larger size ranges, the experimental data clearly suggest a relationship between increased firing and decreased frequency of items in the larger size class.

Figure 9.11 compares the four artifact groups identified in Figure 9.8 with the burned caliche and fire-cracked rock in each of the four size groups. Note that as the number of artifacts increased from 0 to the 18 to 30 range, the size profiles of the burned caliche and fire-cracked rock changed with decreasing percentages in size Classes 2, 3, and 4 and increasing percentages in size Class 1. One explanation for this pattern is that features in the 18-to-30-artifact group resulted from greater reuse than features in the other three artifact groups. It appears that as reuse increased—as indicated by the changing pattern of fire-cracked rock and burned caliche profiles, which were supported by the experimental data—the number of artifacts increased as well.

The data suggest a significantly smaller percentage of large fire-cracked rocks in the examples with 18 to 30 artifacts, though the overall weight and number of burned caliche and fire-cracked rock increases. Two possibilities may account for this apparent paradox. First, the increased number of fire-cracked and rock burned caliche increased the weight, and increased numbers of artifacts may be related to a higher incidence of erosion. Although project analyses compared the same space (13 square meters), it is impossible, given the lack of data on erosion, to rule out this possibility. Second, when the feature was reused, more large rocks were added. The latter would suggest that rock size has some relationship to the reasons that rocks are added to a feature.

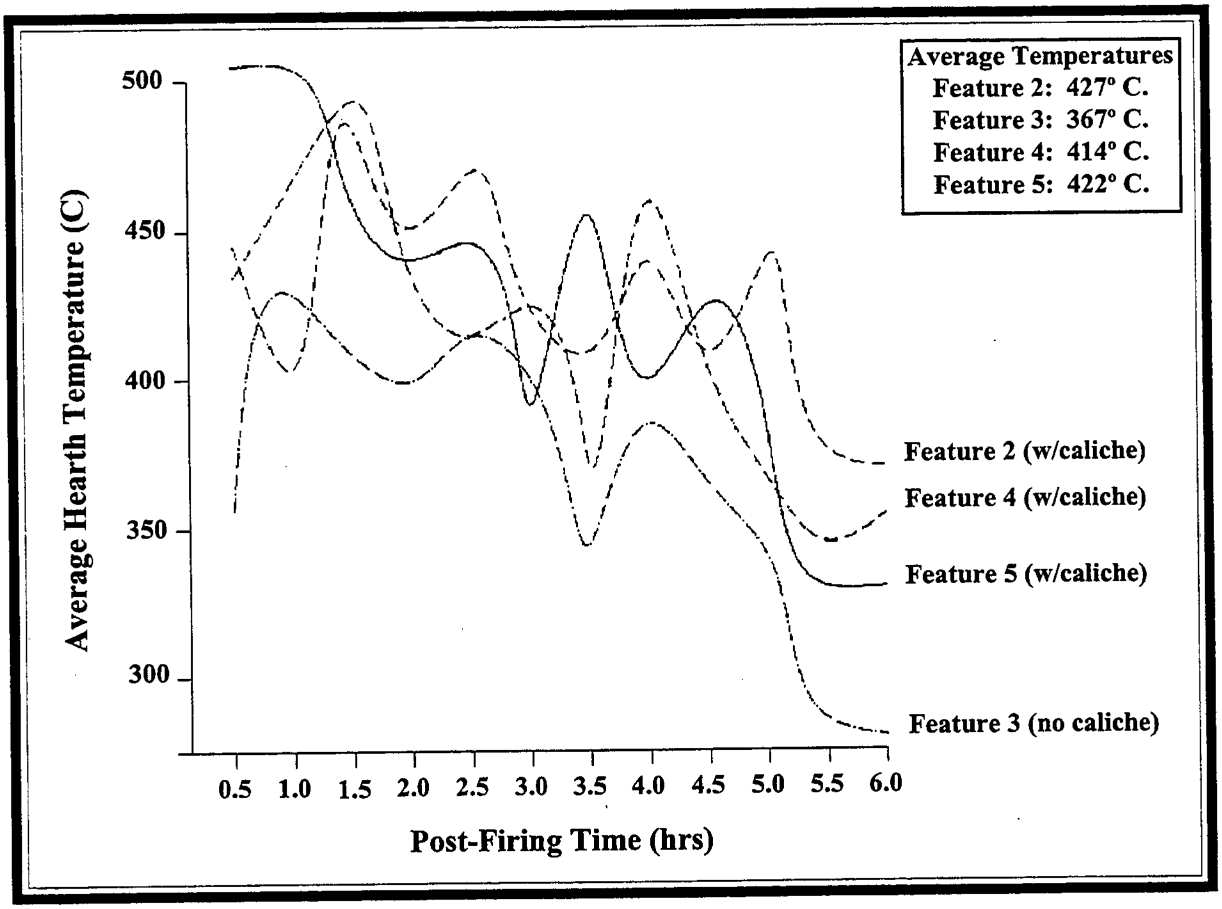

Figure 9.12. Experimental Hearth Temperatures.

The critical question involves why the addition of rock occurs. What is the advantage of using rock? Several avenues should be explored to investigate this question, including flotation analysis, patterns of artifact association, spatial and temporal patterns in the archaeological record, and additional experimentation. However, the extant data and the methodologies available to investigate the reasons for the use of fire-cracked rock and burned caliche in features are limited. Flotation results on this project were disappointing in that only a few features of any type yielded recoverable remains and they probably were related to the eroded condition of the features, as well as their limited use life. Thus, flotation was no help in the present analysis.

The final bit of evidence for the addition of rock and caliche comes from experimental research, which suggests a major difference associated with the use of stone may be an increase in heat retention. Temperature probes were placed in three experimental features of caliche and one with only wood over a 6-hour period. Roughly the same amount of wood was used in each feature. Nine temperature readings in the ash of each feature were averaged (Figure 9.12). Considerable fluctuations were noted through time, some due to the particular placement of the temperature probe during a given measuring event; however, consistently higher temperatures appear to be associated with those features with caliche.

More interesting than the overall temperature is that features with caliche seemed to retain heat longer (Figure 9.12). After 6 hours, temperature differences for features with caliche were consistently higher than features without caliche; after 9 hours the three features with caliche had an average temperature of over 300 degrees Centigrade, while the feature that lacked stone had a temperature of less than 150 degrees (Figure 9.13). Thus, the real advantage of the addition of rock seems to be greater heat retention over a longer time.

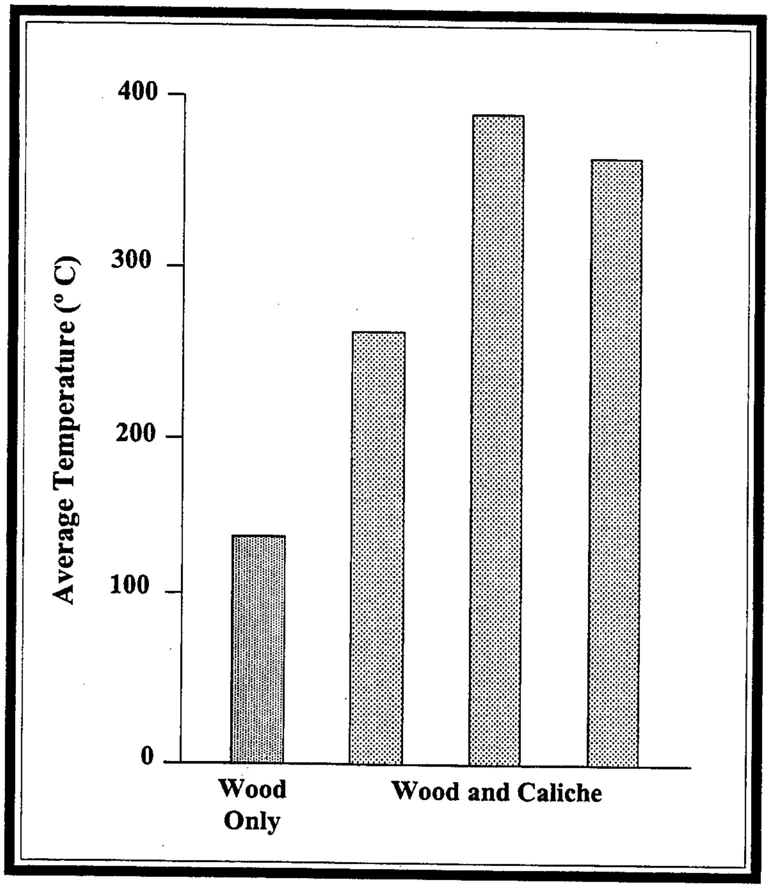

Figure 9.13. Experimental Hearth Temperatures after 9 Hours.

If long-term heat retention was the reason that stone was added to a feature, under what conditions would it have been advantageous? For cooking, long-term heat retention probably related to processing resources that had high starch contents. A number of studies demonstrate that raw starch, being composed of polysaccharides, is incompletely digested. However, with applications of heat and moisture over time, these complex sugars break down into monosaccharides that are more readily absorbed by the body. The critical variable is the exposure of the starch to heat and moisture over time. These also may be an additional advantage in destroying toxins.

Plants in the region that may require heat and/or moisture for effective digestion include various agaves, sotol, and possibly yucca. A focused experimental program on determining the chemical composition and heating requirements of these plant materials may prove beneficial to answering questions regarding the use of rock and/or caliche.

If the features were for heat rather than cooking, the addition of caliche and/or rock may have been related to other factors. Although heat around the experimental fire was not monitored, a subjective opinion is that it did not provide a noticeable difference in the radiation of heat outside the pit. Nevertheless, features with burned caliche and/or fire-cracked rock should radiate more heat outside the feature. The possibility exists that the thermal advantages of the addition of stone may have to do with lengthening the overall time that a hearth radiates heat.

Wood collection experiments were conducted in conjunction with the experimental hearth data (Chapter 11 and Appendix J). The results suggested that wood was rapidly depleted from the immediate environment around a feature. The current density of mesquite is probably greater than at any time in the past, and wood depletion may have been even more rapid in prehistoric times. These data support the suggestion that burned caliche and/or fire-cracked

rock provided a way to extend the heat dispersion of a feature over a greater time.

The answer, however, to the initial query about the use of caliche and/or rock remains unclear. There are significant temperature differences that make sense for plant foods that may have been processed, but the precise reasons for the addition of stone remain unclear.

Summary

The primary interest involved identification of feature and artifact patterns that may have importance for distinguishing different feature types. As with many other classes of data considered in this report, exposure has a significant impact on all the potential relationships identified. The recovery and/or observation of surface artifacts, hearthstone size, and stains had a significant relationship to exposure, and probably indirectly the degree of military impact. Several possible artifact and feature associations, such as the relationship between burned bone and feature volume, were present in the excavated material but these, too, were complicated by erosion. Thus, there were several potential differences in feature types, although no radical differences unambiguously point to different activities or associations. Nevertheless, given that the addition of stone to a feature required some expenditure of time and energy, it is likely that there should be differences in feature types, at least at the broad level of features with and without stone.

The results of several experimental studies, summarized in Appendix J, suggest that many features on the project may have been reused, and that there appears to be a relationship between the amount of reuse and total artifact counts. Reasons for adding stone to features were also explored, and it is suggested that they probably were related to processing certain high starch plants. However, other possibilities for this association cannot be discounted.

Chapter 10

FUNCTIONAL CONTEXT

This chapter uses a variety of previously presented data to explore project level patterns in activities, especially those centered around subsistence. Unfortunately, many artifact data sets, including ceramics and ground stone, as well as much of the floral and faunal data, which traditionally provide information on subsistence, are of little use in the study area. This is probably because of both the types of occupations and the relatively heavy impact by modern vehicles. When coupled with the widespread erosion present in the project area, the data are scanty at best.

Ethnobotanical Results

As a standard procedure on the project, flotation samples, usually in the range of 2 liters of stained fill, were collected from all features with stains. Dr. Glenna Dean of Archaeobotanical Services, Santa Fe, New Mexico, analyzed a total of 30 samples (Appendix K). In addition, Dr. Richard Holloway of Castetter Laboratory of Ethnobotanical Studies, University of New Mexico, analyzed 49 samples (Appendix L).

The results of both ethnobotanical studies are quite similar, and somewhat disappointing with regards to subsistence information. Few charred seeds were recovered; only 3 of the 79 samples contained charred seeds, and all other charred material had a similar low recovery rate. Chenopodium, Caryophyllaceae, and possibly Portulaca were identified in separate features, and several charred grass stems were recovered from features.

Both Dean and Holloway suggest that the low recovery rate is the result of preservation and the practice of subsampling features. The 2-liter samples (though twice as large as commonly collected for analysis), the initial low rate of charred plant remains, and the eroded condition of the features probably suggest, as both analysts argue, that larger samples should be collected. However, even with substantially larger samples, recovery rates do not seem to improve dramatically. For example, flotation results from the GBFELTI project on White Sands Missile Range, New Mexico (Minnis and Toll 1991), where samples 10 times as large as the ones collected here were common, recovered charred seeds in only 8 of 67 samples. Given the fragile nature of most plant remains, the destruction of charred ethnobotanical data by exposure is highly probable.

The extremely low recovery rates may also reflect the intensity of feature use. That is, artifact and feature data suggest that features in the project area were probably used for short periods—perhaps as little as a few days. The limited amount of use should mean a decreased probability of food remains becoming charred. The low recovery rate, then, may also be determined by the nature of the occupation.

Pollen analysis on Project 90-11 was relatively limited. Only 12 samples, all from a single profile on FB7483 (41EP1037), were submitted for analysis (Appendix L). Not unexpectedly, the pollen data are difficult to interpret. A high percentage of the grains are deteriorated, pollen concentrations are low, and much of the identifiable pollen falls in the cheno-am category.

Two samples, however, contained economic pollen. A single grain of *Platyopuntia* pollen may represent the use of cacti, but with only a single grain, the relevance is not clear. In addition, a single grain of *Zea mays* pollen was recovered on FB7483 (41EP1037) adjacent to Feature 44, which has a radiocarbon date of roughly 3400 B.P. There is no definite relationship between the date and the sample because of the extremely rare occurrence and the possibility of pollen movement through the profile. The sample is of interest, however, in documenting the presence of corn at this location.

Faunal Analysis

A variety of faunal remains recovered from the project area were analyzed by Susan Stratton of Western Zooarchaeological Research, Pioneer, California (see Appendix I). These data, in combination with provenience information, were used in an attempt to eliminate faunal material that was likely to be intrusive, and thus unrelated to subsistence. The intrusive samples, which included horned lizards and several small rodent species, were removed and the resulting patterns examined. The faunal data suggest a focus on small and medium sized mammals, with jackrabbit and cottontail probably contributing a substantial amount to subsistence.

As Stratton notes, the presence of burning is an important component in identifying faunal material used for food versus those that are intrusive. While not all animals were processed by cooking and faunal remains can become charred in a variety of ways not necessarily related to subsistence, the presence of burning is an excepted identifier for subsistence items.

Charring was highest among jackrabbits, medium mammals (jackrabbit or larger size class), cottontails, wood rats, and small mammals of the cottontail or smaller size class (Table 10.1). None of the large mammals or birds were burned, and many faunal classes with large sample sizes, such as kangaroo rats and horned toads were never burned.

Table 10.1. Faunal Remains.

Faunal Class	Unburned		Burned		Total	
	#	%	#	%	#	%
Artyodactil	2	100.0	0	0.0	2	100.0
Birds	3	100.0	0	0.0	3	100.0
Cottontail	60	82.2	13	17.8	73	100.0
Horned lizard	43	100.0	0	0.0	43	100.0
Jackrabbit	29	56.8	22	43.1	51	99.9
Kangaroo rat	36	100.0	0	0.0	36	100.0
Medium mammal	43	75.4	14	24.6	57	100.0
Microtus	2	100.0	0	0.0	2	100.0
Mouse	17	100.0	0	0.0	17	100.0
Pocket gopher	9	100.0	0	0.0	9	100.0
Rock squirrel	0	100.0	1	0.0	1	100.0
Small mammal	79	94.0	5	6.0	84	100.0
Wood rat	7	87.5	1	12.5	8	100.0
Unidentified	440	47.3	491	52.7	931	100.0
Total	770		547		1,317	

Faunal material was not common on the project. However, a single trench on FB10411, which cut through the Feature 16 area, produced 289 bones, or 22 percent of all faunal remains recovered from the project. The trench, which was hand dug through a small mesquite hummock, revealed extensive rodent disturbance that made clear delineation of Feature 16 difficult. The portion of the trench within Feature 16 produced 169 bones, 17.2 percent of which were burned. The sections of the trench beyond the Feature 16 boundary yielded 120 bones, only 5.8 percent of which were burned. The lower frequency of burning associated with the trench outside of the feature suggests that some of the material may not be associated with subsistence.

The Feature 16 trench contained 95 percent of all horned lizard remains recovered from the project. Forty-seven percent were from a single provenience. The trench produced 50 percent of all kangaroo rat remains, with 33 percent coming from one level. In addition, the trench yielded 100 percent of all mice, 63 percent of all wood rats, and 37 percent of all small mammals identified on the project. None of these remains were burned. Given the lack of charring, the concentration of these small burrowing animal remains in this one area, and the presence of extensive burrows, the remains of these species were probably intrusive, and they were eliminated from the analysis.

An additional case of concentrated unburned faunal material at a single provenience was pocket gopher remains from a single provenience on FB10417. None were burned, and they also were eliminated from the analysis.

Eliminating the probable intrusive elements provided a clearer picture of the species that were probably of primary importance. Table 10-2 suggests that while several species may have been used, much of the subsistence centered around rabbits. Because many unidentified medium mammals may fall in the jackrabbit size class, and many small mammals may fall into the cottontail size class, it can be concluded that most of the faunal subsistence focused on jackrabbit and cottontails. Large mammals accounted for little of the recovered remains, and small mammals other than cottontails were of minimal importance once the probable intrusives were eliminated.

Table 10.2. Unburned and Burned Faunal Remains with Probable Intrusives Eliminated.

	Unburned			Burned			Total	
Faunal Class	**#**	**%**	**Rank**	**#**	**%**	**Rank**	**#**	**%**
Artyodactil	2	100.0		0	0.0		2	100.0
Birds	3	100.0		0	0.0		3	100.0
Cottontail	60	82.2	1	13	17.8	3	73	100.0
Jackrabbit	29	56.8	4	22	43.1	1	51	99.9
Medium mammal	43	75.4	2	14	24.6	2	57	100.0
Microtus	2	0.0		0	100.0		2	100.0
Rock squirrel	0	0.0		1	100.0		1	100.0
Small mammal	48	90.5	3	5	9.5	4	53	100.0
Wood rat	2	66.6		1	33.3		3	99.9
Unidentified	440	47.3		491	52.7		931	100.0
Total	629			547			1,176	

Immunological Results

In an effort to expand the understanding of subsistence on these occupations, the utility of blood residue analysis on lithic tools was explored. Dr. Margaret Newman of the Laboratory of Archaeological Sciences in Bakersfield, California, conducted blood residue analysis on 68 prehistoric tools (see Appendix H). Newman obtained positive results on 14 prehistoric tools, and 2 modern tools that were manufactured and used to cut up a jackrabbit. One of the modern tools was correctly identified as having rabbit residue; the other modern sample was incorrectly identified as turkey. Previous blind tests conducted with Newman and reported by Amick (1994) suggest that this degree of error is uncommon. However, before the validity of blood residue resulting from a particular animal can be accepted, additional blind tests should be conducted.

The validity of the identifications are open to question, but the positive results suggest a variety of animals may have come in contact with the prehistoric tools. Excluding the single artifact with human blood, an association all too familiar to the modern flint worker, 13 prehistoric samples suggest a focus on deer, dog or coyote, porcupine, rabbit, and rat or mouse. Deer, rabbit, and rat or mouse were present in the faunal remains. Coyotes are common in the central basin, though none were identified in the faunal remains. Porcupine is not common in the central basin at present; however, the animal has been observed in the central basin and is quite common north of the project area.

In spite of the potential problems associated with the immunological analysis, these results, if accurate, hint at a moderate level of dependence on large mammals, specifically deer. This pattern is not present in the faunal remains. Whether the immunological results indicate a subsistence component not revealed by the faunal remains, or the results are incorrect, cannot be determined at present.

Artifact Patterns

As a final component of subsistence, general aspects of the artifact and feature information were summarized. Analyses of both artifacts and features were hampered by their fragmentary conditions, high frequency of reuse, and eroded states. Nevertheless, these data provide some general information on subsistence.

The ground stone analysis suggests a focus on nondomesticated plant foods. Much of the ground stone was fragmentary and the most common identifiable ground stone implements were metate fragments, although there were a few pestle fragments. A wide variety of use-wear patterns and edge angle characteristics in the chipped stone artifacts suggest that both plants and animals may have been

exploited. These observations are further supported by the wide range of formal and informal tool forms.

Finally, the common practice of adding rock to features suggests the possibility that plant species such as yucca, which has relatively high starch content, may have been processed. However, the benefits of adding rock remain unclear, and no additional support for yucca processing in the archaeological record has been documented.

Summary

Artifactual, feature, immunological, and ethnobotanical information is scanty and open to a variety of interpretations. However, the data, though minimal, suggest that no single resource was a focus of exploitation. Rather, a generalized subsistence pattern is suggested for the project area.

If the feature observations have any validity, the presence of fire-cracked rock may indicate a focus on plant processing, though the exact nature of this processing remains unclear. The faunal data suggest the use of both jackrabbits and cottontails, animals currently available in the desert, with other fauna being of minimal importance. The immunological results suggest a focus on both deer and smaller mammals.

No evidence, either in the artifact analysis or in the ethnobotanical data, suggests that mesquite was exploited for food. This is somewhat surprising, as mesquite is certainly present in the area as demonstrated by the wood identification (Appendix M) and was expected to be a major food resource. The pattern may have something to do with processing technology or location. An analysis of plant residue on ground stone may also be necessary to identify mesquite.

These data suggest a pattern of variety. Many plant and animal resources may have been exploited within the project area. The focus appears to have been on small to medium sized animals, probably jackrabbit and cottontail, and possibly certain plant species; however, which plant species remains unclear. The activities suggested to have occurred in the project area were general in nature, and there is no single pattern that is characteristic of these occupations.

Chapter 11

CHRONOMETRIC RESULTS

Radiocarbon Procedures and Results

The primary chronometric technique employed in this study was radiocarbon dating. Features in the study area seldom had large quantities of charcoal in the fill so large quantities of sediment were collected. The samples were water screened through window screen mesh, dried, cleaned, and sent to Beta Analytic, Coral Gables, Florida, for processing. Even with this procedure only 61 of the 308 tested and excavated features, or about 20 percent, yielded sufficient charcoal for a date, and several required extended counting time to reduce the standard error. No accelerator dates were requested, though this would have significantly increased the number of dated features. The total number of ^{14}C samples submitted from prehistoric features on the project was 91.

All radiocarbon samples were corrected for different rates of carbon fractionation, and all have been tree-ring calibrated using the University of Washington correction program (Stuiver and Pearson 1986). The site descriptions in Appendix C list the sample numbers and original dates in radiocarbon years. Table 11.1 presents the site, feature number, the date range at 2 sigma, the number of dates, and the phase assignment.

Table 11.1. Radiocarbon Dates for Features.

Site	Feature	2-Sigma Range	Dates	Period/Phase
FB6741 (41EP1028)	7	2356–2149	1	Late Archaic
	135	4803–4314	2	Middle Archaic
	152	2711–2159	1	Late Archaic
FB7483 (41EP1037)	6	2306–1870	1	Late Archaic
	12	3546–3004	1	Late Archaic
	13	1560–1310	1	Mesilla
	14	1700–1354	1	Mesilla
	16	7429–6889	1	Early Archaic
	19	3238–2884	2	Late Archaic
	32	3546–3004	1	Late Archaic
	36	1689–1390	1	Mesilla
	38	1412–1296	2	Mesilla
	43	2745–2397	6*	Late Archaic
	44	3631–3359	2	Late Archaic
FB7508 (41EP982)	7	4419–3982	1	Middle Archaic
FB7510 (41EP978)	38	1415–1300	2	Mesilla
	39	2359–2081	1	Late Archaic
	40	1542–1352	2	Mesilla
	68	2039–1720	1	Late Archaic

(Continued on next page.)

Table 11.1. Radiocarbon Dates for Features (continued).

Site	Feature	2-Sigma Range	Dates	Period/Phase
	74	1520–1306	2	Mesilla
FB7517 (41EP972)	45	2736–2349	1	Late Archaic
FB7520 (41EP970)	2	6661–6289	1	Early Archaic
FB7547 (41EP964)	3	2739–2339	1	Late Archaic
	54	1420–1194	1	Mesilla
	86	2349–2023	1	Late Archaic
FB7580 (41EP1753)	4	1890–1610	1	Late Archaic
	6	3159–2779	1	Late Archaic
	8	3160–2800	2	Late Archaic
	26	2739–2213	1	Late Archaic
FB10411	16	730– 540	1	El Paso
	17	930– 670	1	El Paso/Mesilla
FB11299	9	905– 675	2	El Paso
FB12069	7	1540–1290	1	Mesilla
	15	1520–1300	1	Mesilla
	18	1690–1352	1	Mesilla
	16	1540–1392	4*	Mesilla
	22	1410–1180	1	Mesilla
FB12072	6	1875–1634	3*	Late Archaic
	12	500– 0	1	Historic
	17	2036–1740	1	Late Archaic
	15	1924–1738	5	Late Archaic
	20	2037–1820	3	Late Archaic
FB12100	7	1410–1060	1	Mesilla
	27	1055– 926	3	Mesilla
	31	1256– 950	1	Mesilla
	32	1173– 931	1	Mesilla
FB12102 (41EP4908)	3	2718–2339	1	Late Archaic
	9	1920–1350	1	Mesilla
FB12218	4	2349–1953	1	Late Archaic
FB12224 (41EP4913)	4	4419–3984	1	Middle Archaic
FB12225 (41EP4914)	1	3318–2849	2	Late Archaic
	2	3321–2881	1	Late Archaic
FB12243	1	2959–2739	1	Late Archaic
FB12316	9	2739–2329	1	Late Archaic
FB12319	2	1924–1620	1	Late Archaic

(Continued on next page.)

Table 11.1. Radiocarbon Dates for Features (continued).

Site	Feature	2-Sigma Range	Dates	Period/Phase
FB12330	1	1410–1193	1	Mesilla
	2	2149–1870	1	Late Archaic
	3	1516–1303	1	Mesilla
	6	2146–1824	1	Late Archaic
	7	1173–959	3*	Mesilla
FB12331	3	2298–1890	1	Late Archaic

Note: Where multiple dates are present from a single feature, the dates are averaged if the standard deviations overlapped at 1 sigma.
** One or more dates not used in average because they were significantly different from associated dates from feature.*

Of the 61 features, dates of 1.5 percent are in the Historic period, 5 percent in the El Paso phase, 34.5 percent in the Mesilla phase, 51 percent in the late Archaic, 5 percent in the middle Archaic, and 3 percent in the early Archaic. No Paleoindian dates were obtained. What is more important than the number of dates in a given phase is the pattern of dates through time (Figure 11.1). The dates are not spread throughout the phases, but seem to form a fluctuating pattern through time. Dates on three features at the end of the middle Archaic are followed by a 500-year-period that lacks dates. There is then a cluster of nine features around 3100 B.P., followed by a gap of 200 years. At about 2500 B.P., a cluster of seven features occurs, followed by a gap of 100 years, and then a consistent pattern of dates throughout the rest of the late Archaic and into the early Mesilla phase. The cluster of feature dates early in the Mesilla phase is followed by a rapid drop off. Few feature dates are later than 1000 B.P.

Some of the specific modes and dips in the figure may be due to the calibration procedure (Miller 1993b). However, if the number of feature dates can be used as a rough indicator of occupational intensity (Berry 1982; Wills 1988), then the late Archaic and early Mesilla periods were the most heavily used. This suggests a very different pattern of occupation for the study area than is commonly proposed for the entire region.

Old Wood Problem

The pattern of radiocarbon dating identified on the project is contrary to the regional models of population growth and levels of intensity that suggest the greatest occupation at a regional level was in the later time periods. The possibility exists that the dates may be systematically older than the features actually date. Schiffer (1987), for example, documents radiocarbon dates in the Hohokam region that may be systematically earlier than the actual occupations as a result of the "old wood" problem. That is, any given date may miss the target date by several centuries if the date is derived from dead wood, which may survive in arid climates for several hundred years (Schiffer 1987). Carmichael (1985) argues that radiocarbon dates from features excavated on the western side of the Franklin Mountains are a result of the use of old wood. Most charcoal dates from Project 90-11 are on mesquite, a wood that should survive for considerable periods in arid settings.

To assess the potential that dates derived from features on Project 90-11 are systematically older than the actual use date of the feature, project personnel collected old wood from the present environment and monitored to determine how rapidly it is exhausted by collection. Although charcoal from annual plants, the dating of which would provide direct information on the magnitude of the old wood problem, is lacking, the degree of the problem can be investigated by dating old wood from the modern surface.

Nine mesquite wood samples were collected from the project area. All had evidence of insect boring, and general structural decay. These samples were cut in half and one-half was submitted for radiocarbon dating. In addition, a tenth sample derived from wood burned in an experimental hearth in the study area was submitted; this sample represents a cross section of wood available from throughout the area around the feature.

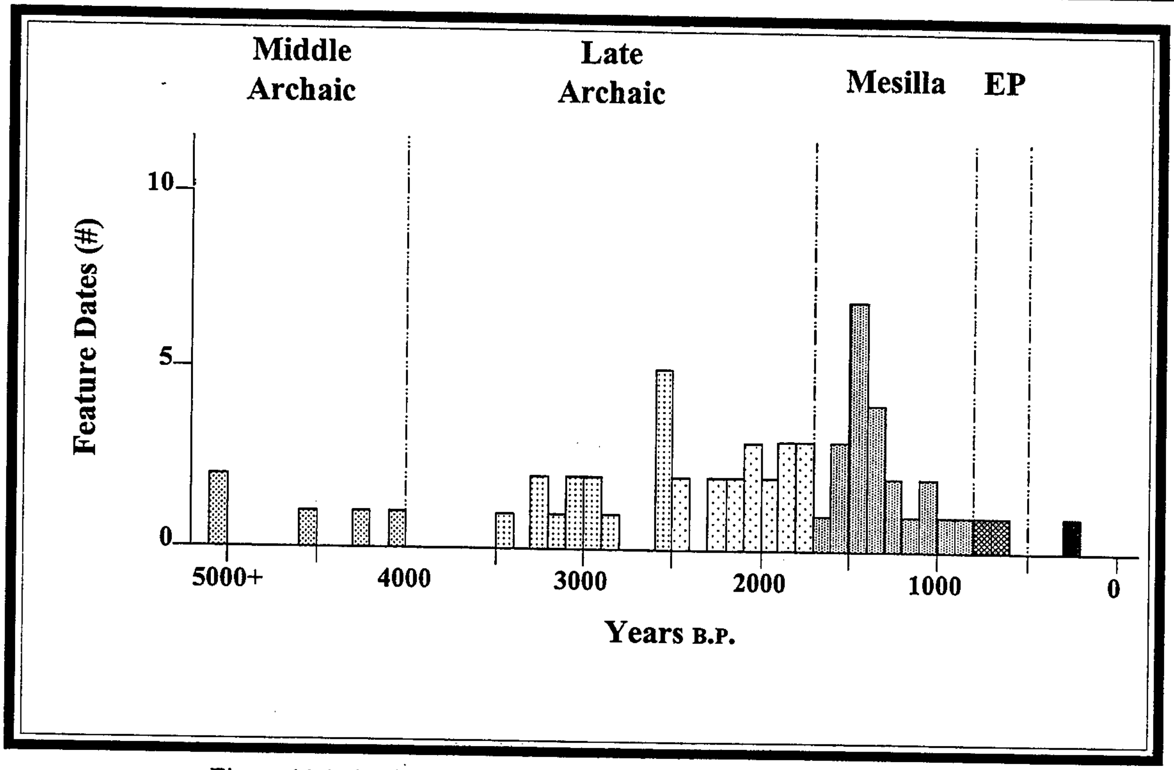

Figure 11.1. Radiocarbon-Dated Features on Project 90-11 ($N = 61$).

Five of the 10 samples produced modern radiocarbon ages, suggesting that even though these specimens were decayed, they were of recent age (Table 11.2). Four of the remaining five samples produced calibrated radiocarbon dates between 300 and 0 B.P. These dates, like the previous five, could be modern in age. Using the midpoint of the range, the same procedure used in the archaeological samples, these samples date to 150 B.P. The final wood sample, Beta Number 53413, produced an age of 350 ± 50. As this sample was significantly different from the other nine, the remaining portion of the specimen was submitted for dating. This specimen, Beta 54062, produced a date of 10 ± 60. The reason for the radically different dates on the same piece of wood is not known; however, the average of the two dates produces a range comparable to the other wood samples. Finally, the single specimen from the experimental hearth produced a modern date.

The fact that none of the 11 samples produced an old wood signature in spite of efforts to collect decayed wood suggests that at least in the current environment, old wood is not common. Of course, this does not necessarily mean that old wood was not common in the past. However, monitoring the rate at which dead wood is exhausted in the current environment suggests that dead wood would have been rapidly depleted around a series of features.

Table 11.2. Radiocarbon Dates on Old Wood.

Beta Number	Material	^{13}C Adjusted Date
53410	Wood	90 ± 50
53411	Wood	110 ± 50
53412	Wood	Modern
53413	Wood	350 ± 50
53414	Wood	30 ± 60
53415	Wood	110 ± 70
53416	Wood	Modern
53417	Wood	Modern
53418	Wood	Modern
53419	Wood	130 ± 70
54063	Wood charcoal	Modern
54064	Wood (#53413)	10 ± 60

Observations on the rate of wood depletion are from wood collection experiments conducted around a series of experimental features built in the project area. The amount of time required to collect enough dead surface wood to fuel a single burning of a hearth was monitored in each of six collection events. After four collections the amount of time required increased rapidly (Figure 11.2 top). In fact, it took considerable begging and pleading to convince individuals to continue to look for dead wood on the surface after the fourth collection event.

A similar series of experiments in the same area involved collecting all wood, including dry or dead wood on mesquite bushes. The overall time required increased with each collection event but the increase was much more gradual and the time involved was less than for the collection of surface wood (Figure 11.2 bottom). These data suggest that, at least in the current environment, any systematic focus on surface wood that is likely to be of greater age would be difficult to sustain for more than a few burnings.

Given that the density of mesquite is probably higher now than at any time in the past, the time pressures revealed in the current setting would have been exacerbated in the past. Coupled with the radiocarbon dates on modern surface wood, these collection results suggest that old wood may certainly have been present in past environments, but it is unlikely to have been a significant contributor to any given feature. Consequently, the patterns of earlier-than-expected dates for features in the project area are probably not significantly impacted by the old wood problem.

Spatial Patterns

Feature dates on any given site often span several thousand years (Table 11.1; Appendix N). These dates, which are unlikely to reflect selection bias in either the past or the present, document a pattern of small, short-term occupations suggested by the surface distribution of artifacts.

For example, FB7483 (41EP1037) had 11 dated features that spanned roughly 6,000 years, with occupations in the early and late Archaic period, and in the Mesilla phase. The recovery of what are thought to be late Formative period projectile points from the surface of the site suggests an El Paso phase occupation. Yet, no ceramics were recovered during the surface collection or testing of this site. The site, then, is probably composed of a series of occupations over several thousand years.

The probability that a given site assemblage is composed of repeated occupations over several millennia complicates any direct use of site assemblages for considering temporal changes in factors such as raw material types, lithic attributes, or assemblage composition. The degree to which intersite and intrasite comparisons can be made is dependent on the degree to which discrete clusters of material or dated features can be located. The spatial clustering of artifacts on the surfaces of some sites suggests that discrete clusters exist within larger sites. Dated features within sites support this suggestion.

One excavation area, located on the northern end of FB7483, had five dates from four features within the 103 square meters of excavation (Figure 11.3). Using the midpoint of the 2-sigma range, the dates range from 1354 to 1540 B.P. The sigmas overlap in all cases. While it is impossible, given the standard error associated with radiocarbon dates, to demonstrate that these features represent the same occupation, there is no statistical reason to suggest that the features are of a different age. A similar pattern existed for a cluster of features on FB7510 (41EP978) (Figure 11.4), with features dating between 1358 and 1447 B.P., and FB12225 (41EP4914) had two features dating around 3100 B.P. (Figure 11.5). Several other sites had spatially associated features with similar dates.

This pattern of overlapping dates in close spatial association is common. However, many sites had features in proximity that were temporally different; FB7580 (41EP1753) had a variety of features, three of which were dated (Figure 11.6). Two date around 3000 B.P., while a third has a midpoint at 2476 B.P. At 2 sigmas, dates from the two feature clusters do not overlap. It is still possible that the dates represent a single occupation, but the most conservative explanation is two different occupations.

An example of differences between dates on features and associated assemblages is Feature 135 at FB6741 (41EP1028) where a middle Archaic date of 4559 B.P. is associated with ceramics (Figure 11.7). Either these are some of the earliest ceramics in the New World or the association is spurious. When the distribution and quantity of ceramics are considered relative to the feature, it is clear that the ceramics are most likely unrelated to the date. Most of the ceram-

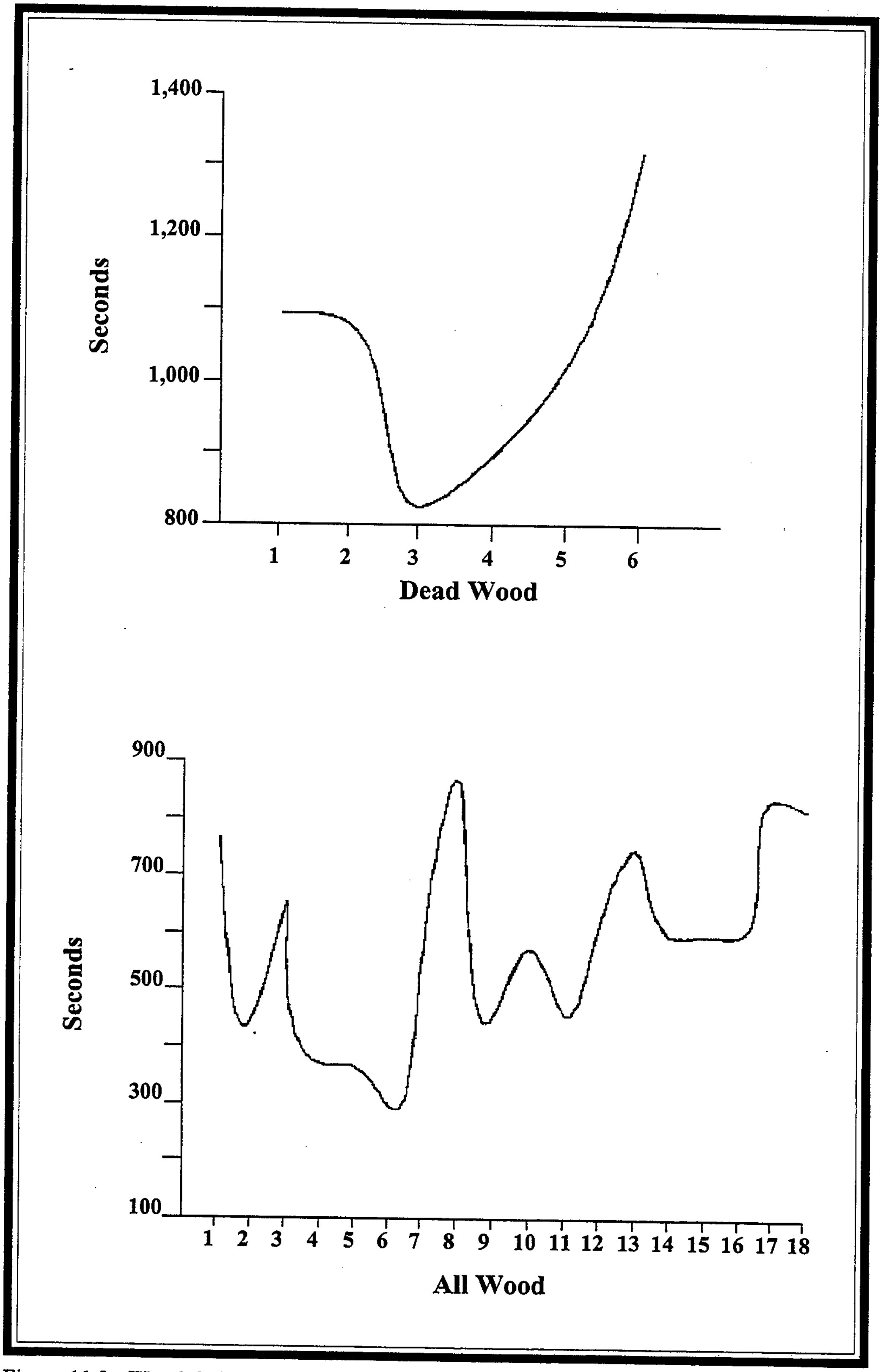

Figure 11.2. Wood Collection Times by Event. *Top,* dead wood collected; *bottom,* all wood collected.

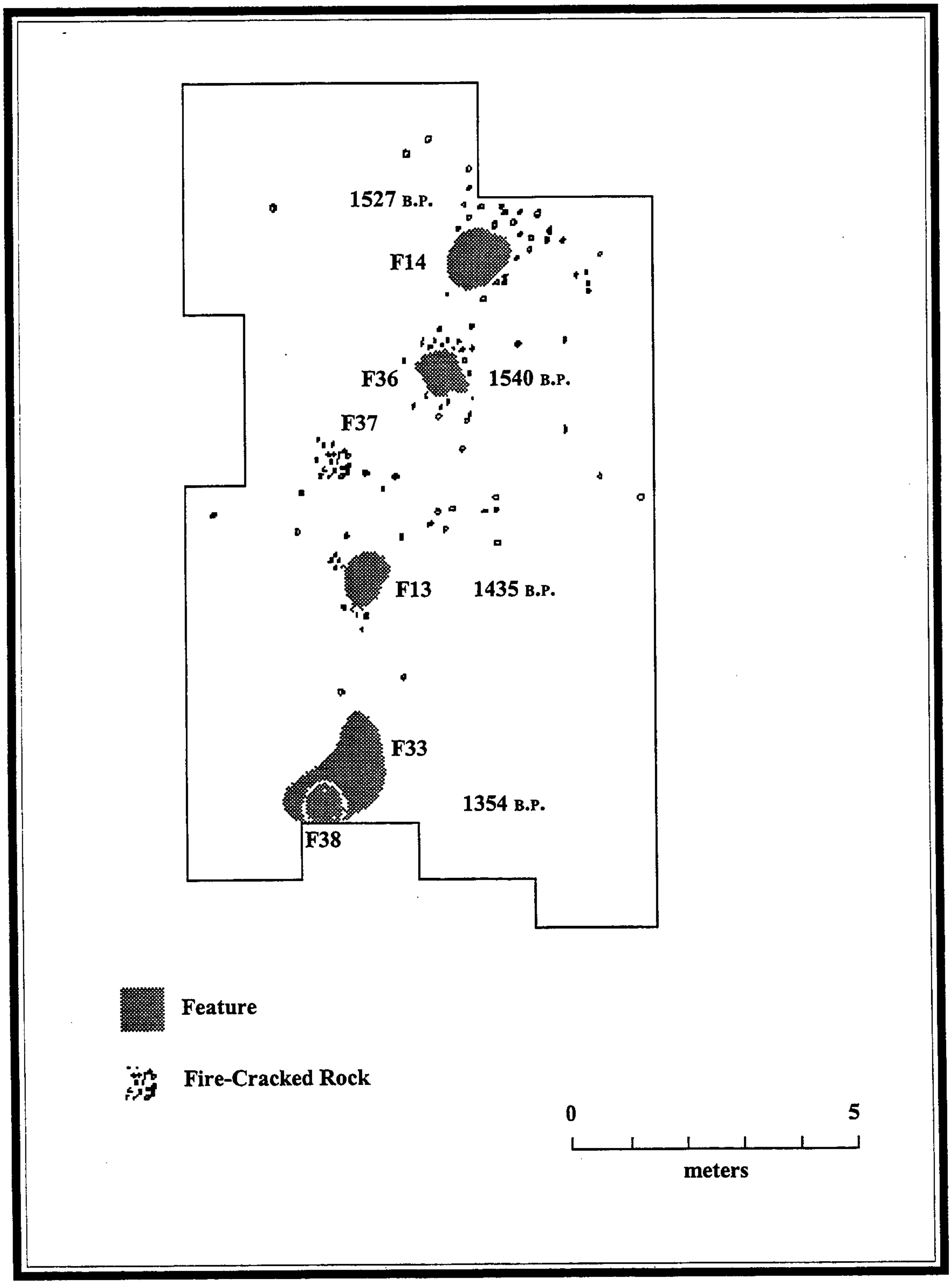

Figure 11.3. Overlapping Dates in Close Spatial Association at FB7483 (41EP1037). Two dates for Feature 38 are averaged.

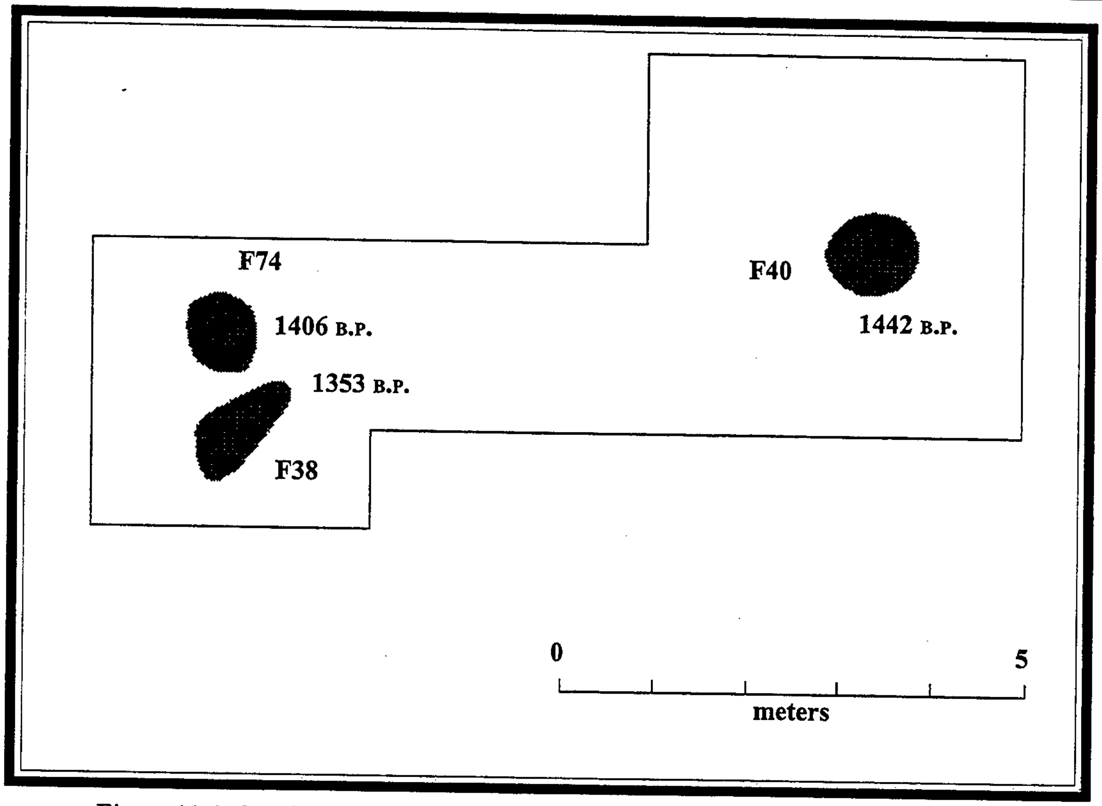

Figure 11.4. Overlapping Dates in Close Spatial Association at FB7510 (41EP978).

ics in terms of weight are in the southwestern portion of the excavation block, and the five closely associated with the feature are small, accounting for a total weight of only 0.5 grams. The association of ceramics with the feature is probably the result of erosion.

Although the larger sites in the project area comprise several different occupations, it is possible to isolate spatially discrete clusters of material within sites for more detailed temporal and adaptive comparisons. The fact that multiple features are statistically the same in several cases suggests spatial separation between occupations within a site. This separation, while encouraging, does not necessarily mean that the assemblages spatially associated with these dates are associated with the features. This is especially the case in environmental settings that have been subject to extensive erosion and a high incidence of use.

Occupation Patterns

Although feature dates span a period from the early Archaic period through the El Paso phase, most fall in the late Archaic period and early Mesilla phase. Whalen (1980) notes a similar pattern in his small camp study, as did researchers on Loop 375 (O'Laughlin and Martin 1990; O'Laughlin et al. 1988).

To explore this pattern, a list of 117 radiocarbon dates from features in the central basin was assembled, including those from Project 90-11, Whalen's (1980) small camp project, the Loop 375 project (O'Laughlin and Martin 1989; O'Laughlin et al. 1988), and several other smaller projects in the region (for example, Kauffman and Batcho 1988). The sample from the Loop 375 project was limited to the central basin, an environment comparable to the current project. These dates were tree-ring corrected and plotted at ± 2 sigma (Figure 11.8).

If the number of radiocarbon dates can be used as a measure of the intensity of use, a fluctuating use intensity is indicated. While the intensity of use appears to have increased through time up to 1450 B.P., there were times when use of the basin was frequent and times when use was low. For example, the 500-year gap between 4000 and 3500 B.P. of Project 90-11 remains, as do the major periods of use around 3000 B.P., 2500 B.P., and 1500 B.P. A new peak, at just before 2000 B.P., emerges. There are still few dates after 1000 B.P. The exact location of the

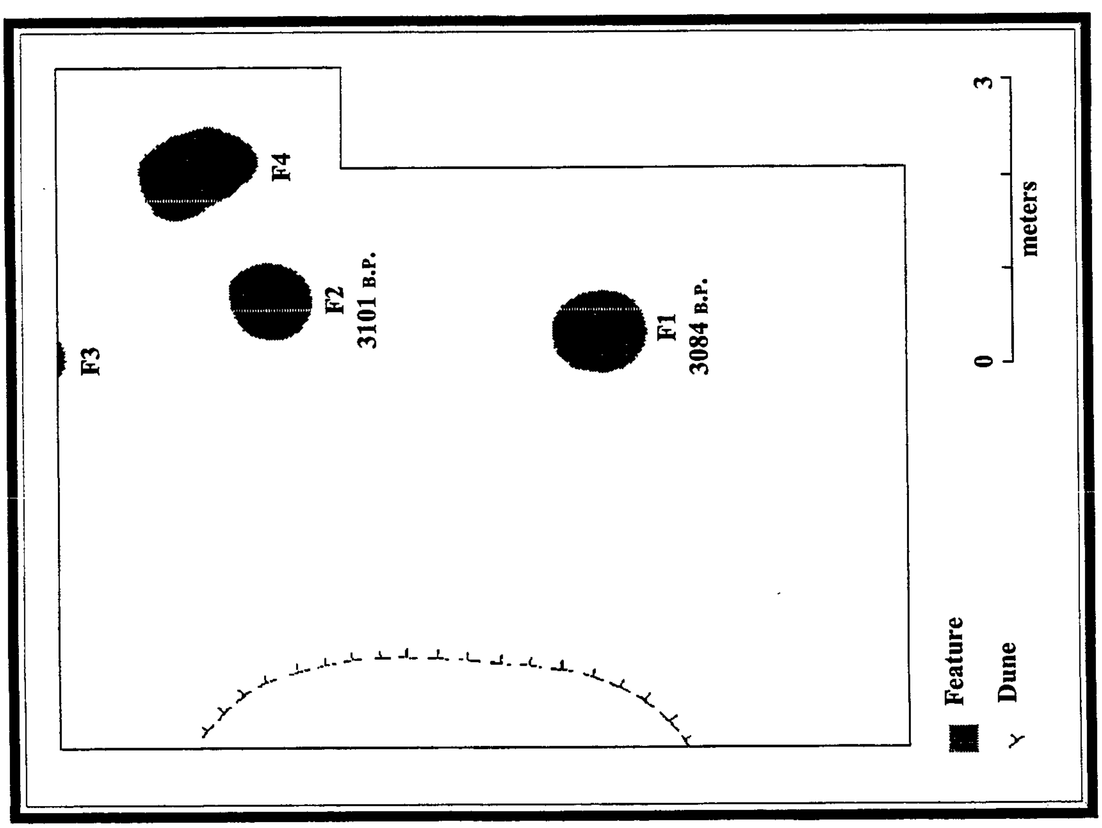

Figure 11.5. Overlapping Dates in Close Spatial Association at FB12225 (41EP4914).

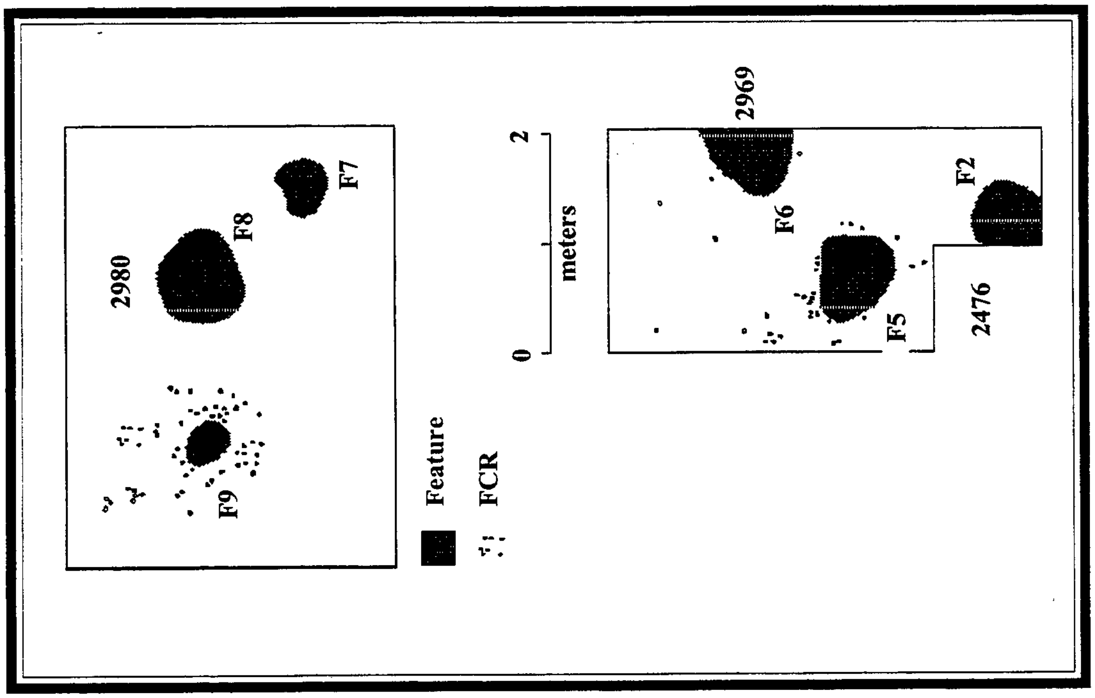

Figure 11.6. Overlapping Dates in Close Spatial Association at FB7580 (41EP1753).

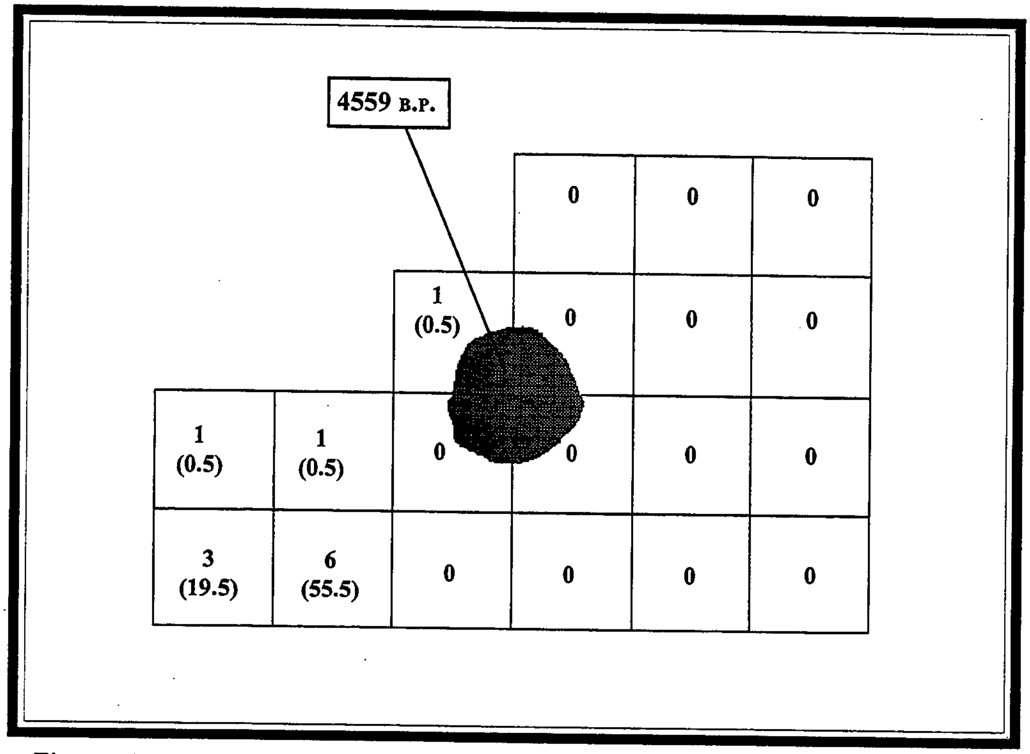

Figure 11.7. Ceramic Distribution and Weight (gr) of Feature 135, FB6741 (41EP1028).

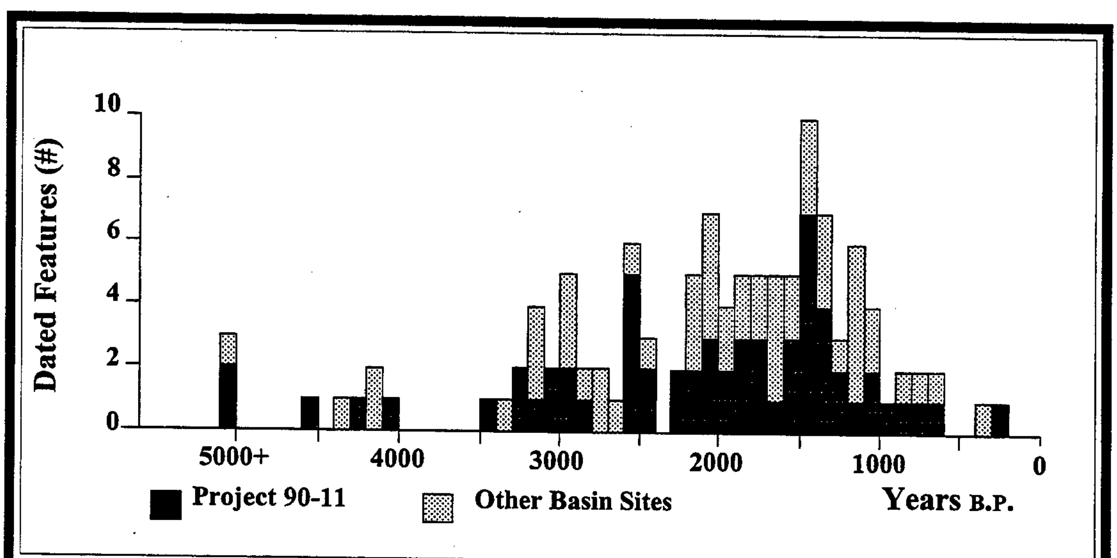

Figure 11.8. Radiocarbon-Dated Features in the Central Basin.

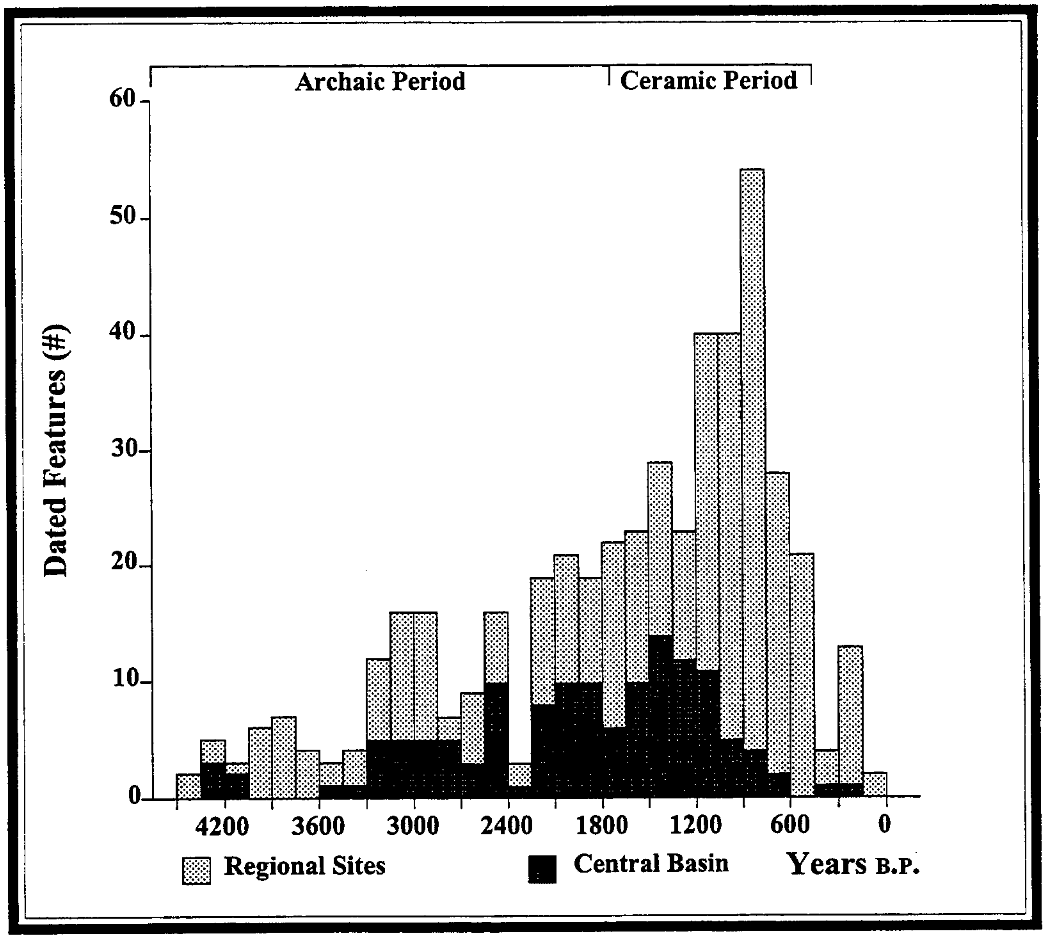

Figure 11.9. Radiocarbon Dates of Features from the Region ($N = 471$).

peaks are altered by changing the histogram intervals, but a fluctuating pattern remains. While this pattern may be, in part, a function of the calibration procedure (Miller 1993b), major patterns occurring over several hundred years, such as the rapid decline of dates in the late Mesilla and through the El Paso phase, suggest a change in use of the central basin late in the prehistoric sequence.

To assess the pattern of declining dates a list of all radiocarbon-dated features in the Jornada area was compiled with the help of Dr. Susana Katz, who was directing an early phase of a chronometric project for the Fort Bliss Conservation Division. The list is extensive, but not exhaustive; many dates are not included because the necessary information was not available, the original radiocarbon date was not reported in a form conducive to calibration, or the feature information was not sufficient. If spite of these problems, a list of 471 dated features, all of which were tree-ring calibrated, was compiled (Figure 11.9).

The regional patterns are quite different from the central basin patterns. While the increase is similar in central basin dates, three regional patterns suggest a much later use with a peak more in line with the general cultural-historical sequence. The similarity suggests that the central basin pattern of a dramatic decrease in features after 1350 B.P. represents a significant departure from the traditional culture history sequence.

Obsidian Hydration

The second major chronometric technique used was obsidian hydration. A total of 128 artifacts (143 dates), most from surface contexts, from 27 different archaeological sites was analyzed by Diffusion Laboratory, Archaeological Services Consultants, Columbus, Ohio (Appendix O). These samples were visually sourced as belonging to the Obsidian Ridge or Group 2 source, which has a previously developed induced hydration rate. Obsidian Ridge material is translucent, has a feathery appearance, and is quite distinct from the other major source in the region, Grants Obsidian, which is black and has numerous inclusions. The effective hydration temperature (EHT) for the project was estimated based on a series of temperature and humidity cells placed in the project area, and different EHTs were used for surface and subsurface materials.

The results of this dating technique, summarized in Table 11.3, are considerably different from those suggested by the radiocarbon dates on features. Almost half the obsidian dates are in the El Paso phase (27.3 percent) and Historic period (19.6 percent). Especially troubling are the dates in the Historic period, which has little other indication in the project area. Also, most of the Mesilla phase are in the closing centuries of the period, between 750 and 1150 A.D. In fact, 89 of the 143 dates, or 65 percent, are after the early Mesilla time frame, a period with few radiocarbon dates.

Table 11.3. Induced Obsidian Hydration Dates.

Period/Phase	Dates (#)	Dates (%)	Cumulative %
Historic/ Modern	28	20	20
El Paso phase	39	27	47
Mesilla phase	44	31	78
Late Archaic period	23	16	94
Pre-late Archaic	9	6	100
Total	143	100	

Some evidence suggests a late presence that may not be associated with features. For example, several projectile points found on the project area probably fall in the El Paso phase, and there are several radiocarbon dates for this time period. However, little evidence supports the major occupation in the sixteenth, seventeenth, and eighteenth centuries suggested by the obsidian dates; one feature date falls in this period, and one ceramic scatter may be historical. Other projects conducted in the central basin have failed to record any major evidence for occupation during this period (Kauffman and Batcho 1988; O'Laughlin and Martin 1989; O'Laughlin et al. 1988; Whalen 1977, 1978, 1980). The obsidian dates appear to be too recent, possibly a function of problems in the rate assumed for the formation of the hydration rims.

The rate used for the obsidian samples was derived by the induced method and adjusted for the EHT on the project. While this approach is independent from other dating techniques, and may ultimately prove effective, the results from Project 90-11 simply do not make sense relative to other dating information. The problem may well be related to obtaining an accurate estimate of the EHT, and therefore the rate, for an area. For example, the hydration rate, which is a function of the experimental results and the EHT, on the surface of the project area is 16.21^2 microns per 1,000 years. For the subsurface material, the rate is 12.81^2 microns per 1,000 years. These rates vary as a result of differences in the relative humidity and temperature at the surface relative to the subsurface. Thus, a sample with a rim width of 4.17 on the surface yields a date of A.D. 919, while an item with the same rim width from a buried context produces a date of A.D. 663. As the rates are nonlinear, these differences are exaggerated at thicker rim widths, such that dates on rim widths of 5.8 may differ by as much as 500 years between surface and subsurface locations.

Although these different rates make sense in terms of the differences in relative humidity and temperature between locations, it is important to recall that at one time, all sites were surface sites. Without knowing in detail the history of deposition and exposure associated with a given artifact, the assumption that an obsidian item recovered from either the surface or the subsurface was always in that context is not justified. Much of the project area was impacted by erosion sometime around 7000 B.P. and sometime after 800 B.P. There may, of course, have been other deflation and deposition events. The exposure of some obsidian by erosion, as well as covering by deposition associated with that erosion, may be highly variable through time. Much of the recent exposure of obsidian, for example, may have occurred over the last 150 years with the introduction of cattle into the area. If this is the case, the assump-

tion of different rates may be spurious, as much of the surface material may have only recently been exposed. Again, this recent episode of erosion and deposition may be only one of several such events that occurred since the piece was deposited on the surface. Without a detailed knowledge of the history of exposure and deposition of the item— knowledge that is not likely to be available for most of the obsidian items—there will always be a substantial degree of uncertainty associated with the EHT, and, by extension, the hydration rate and the absolute date.

Yet, all is not lost. Assuming that the EHT of an item was not reliable for the vast majority of samples on this project, and assuming that dates may differ by several hundred years, the problem was approached by developing a rate empirically through regression analysis. This approach has several disadvantages, foremost of which is linking obsidian to another chronometric technique, radiocarbon dating. This linkage, which provides the chronometric dates for an obsidian rim width, introduces additional uncertainty, both in the association of an obsidian item with a radiocarbon date and the standard error on the radiocarbon date itself. The approach also does not take into account all the factors, such as EHT differences, that make a difference in the hydration rate. Assumptions about EHT require knowledge about the history of the item that is not and probably will never be available. These assumptions radically change the date assigned to an item, and until there is a better understanding of these effects, making these assumptions may be unwise. The approach used here simply assumes that while different EHTs for any given item may produce radically different rims and thereby erroneous dates, there is no systematic error between EHTs and rim widths.

An attempt to develop a hydration rate empirically used eight obsidian rim width readings and associated radiocarbon dates. The samples are from throughout the area, including near the Hueco Mountains (Scarborough 1986), the Organ Mountains (Hard 1986?), West Mesa (Camilli 1986), the Rio Grande (O'Laughlin 1981), and the central basin (Whalen 1977). One sample from FB12330 Feature 7, with a rim width of 2.69 and a mean radiocarbon date of 1066 B.P., was used. These eight rim widths represent, in several cases, the average of several samples. For example, three rim widths of 2.89, 2.48, and 7.37 microns for the Meyer Pithouse Village (see Scarborough 1986, 1992) are on file at the Fort Bliss Directorate of Environment, Conservation Division. The site is well dated to 767 B.P. Because the third rim measurement was considerably different from the first two, it was discarded and the two remaining rims were averaged to arrive at a rim width of 2.69.

While additional samples would be ideal, these eight average rim widths are from relatively well-dated sites. All samples are Group 2 obsidian and all rims were read by Diffusion Laboratory. Radiocarbon dates associated with the samples span over 3,300 years. The intercept on the regression was assumed to be zero. That is, a rim width of zero was assumed to represent 0 B.P. Finally, 1950 A.D. was used as the 0 B.P. point, and all dates were converted into years before present. The 1950 date makes the analysis roughly comparable to the radiocarbon scale.

Several regressions were run on the rim widths and associated radiocarbon dates. The relationship is nonlinear in that newly fractured rims seem to hydrate relatively rapidly at first and then more slowly over time. As this nonlinear relationship makes the development of a linear regression model difficult, a series of transformations were applied to the rim widths. The most satisfactory transformation was raising the rim width to the 1.3 power. The results of the transformed rim widths relative to dates produces a linear relationship (Figure 11.10).

A regression was then run on the cases. The coefficient of determination (r2) on the relationship is .98, suggesting a fairly robust relationship. The relationship is modeled by the equation:

$$\hat{Y} = 212.3 * (\text{rim})^{1.3} + 1.12$$

The intercept of 1.12 is essentially irrelevant.

An examination of residuals from the equations suggests that there is no pattern, though in three cases the studentized residuals (ratios of the residuals to standard errors) are over an absolute value of 1.5. The standard error of the predicted value ranges from 65 to 138. Thus, while the overall fit of the model is good, there is still considerable variability in dates that are not directly related to variation in rim width. These results are not unexpected given factors that may affect obsidian rim formations and dates.

Results of the regression analysis were used to assign dates to 143 obsidian samples from Project 90-11 and three from subsequent work by Diffusion Laboratory (Appendix P). Provenience data and a

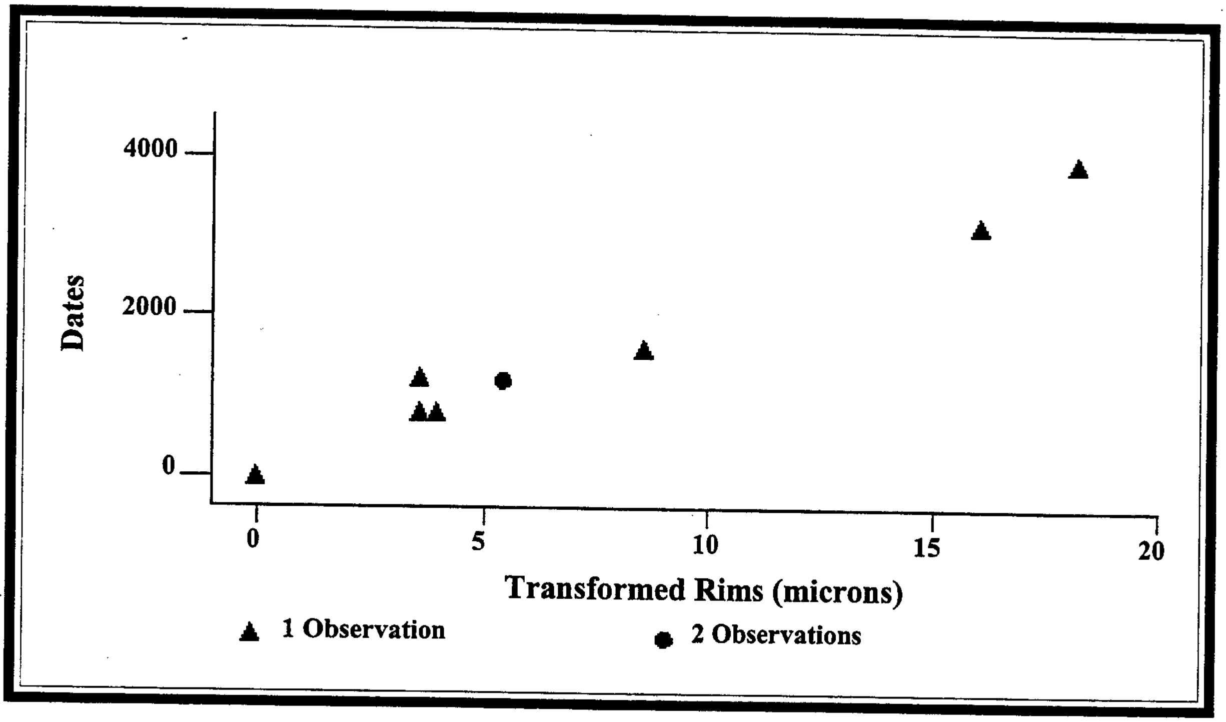

Figure 11.10. Radiocarbon Dates by Transformed Rims.

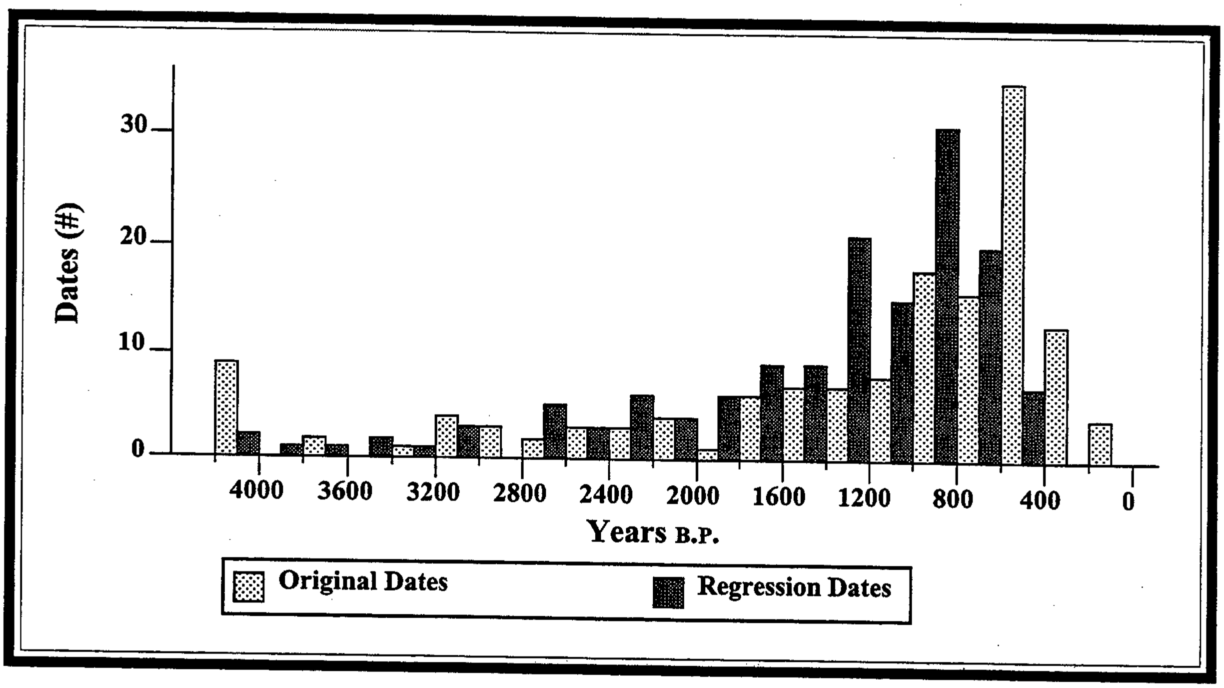

Figure 11.11. Comparison of Obsidian Hydration Dates.

site-by-site summary of the dates with these primary and secondary phase assignments are included in site descriptions in Appendix C.

The results from the regression equation at a phase level (Table 11.4) are considerably different from those presented previously. Specifically, the concentration of dates in the Historic period is drastically reduced, as is the overall percentage of dates in the El Paso phase. Most of the obsidian dates are in the Mesilla phase, and the late Archaic period now has about one-fourth of the dates. While this distribution is more in line with that of radiocarbon dates, the Pueblo period still has a higher number of dates (Figure 11.11). The original dates produce a curve that suggests occupation peaks between 400 and 600 B.P. (A.D. 1550 to 1350), and the regression dates peak between 800 and 1000 B.P. (A.D. 950 to 1150), at the end of the Mesilla phase. A smaller peak between 1200 and 1400 is similar to that reported for the radiocarbon curve in the study area.

Table 11.4. Regression Obsidian Dates by Phase.

Period/Phase	Dates (#)	Dates (%)	Cumulative Percentage
Historic/ Modern	2	1.4	1.4
El Paso Phase	25	17.1	18.5
Mesilla Phase	81	55.5	74.0
Late Archaic Phase	35	24.0	98.0
Pre-late Archaic	3	2.1	100.1
Total	146	100.1	

The results using the regression technique appear comparable to the radiocarbon dates. There is still a discrepancy in the number of obsidian dates relative to radiocarbon dates in the El Paso phase, but the large number of obsidian dates in the Historic period produced by the original obsidian analysis do not seem tenable. Therefore, the results from the regression analysis were used to assign absolute dates to the obsidian on this project. However, the regression equation was based on a small number of samples and neither the EHT nor detailed sourcing of obsidian was considered. Also, there were additional problems concerning the standard errors associated with obsidian dating, as well as with the radiocarbon dates used to develop the regression. Given these problems, there is a fair amount of uncertainty associated with any particular obsidian date.

To assess the obsidian dating technique further, a list of 277 Group 2 rim readings from obsidian samples throughout the region was compiled. All the samples were read by Diffusion Laboratory and the original data are on file at the Conservation Division at Fort Bliss. The regression equation was applied to these dates and the regional hydration sample was compared to the regional radiocarbon sample of 471 (Figure 11.12). With a few minor differences, the two independently derived curves are surprisingly, and encouragingly, similar. This similarity suggests that the obsidian dates are a reasonable approximation of the pattern "true" dates. If anything, the obsidian dates appear to be a few hundred years earlier. This discrepancy may be related to the use of old wood, as the difference between the two curves is within the 2-to-300-year range found in the modern samples.

Comparison of obsidian dates from Project 90-11 with radiocarbon dates from the central basin (Figure 11.13) indicates that the obsidian dates are much later in time. In contrast to the pattern identified in features where use of the central basin is increasingly less common after 1350 B.P., the obsidian dates suggest a continuing use. The peak in obsidian dates from the project area is approximately 850 B.P. The conclusion is that in the central basin, the two dating techniques reflect different behavior patterns. One range of activities may be associated with the production of features, and another set of activities may be associated with the generation of artifacts that do not involve features. These potentially different activity sets are supported by limited data on projectile point styles, which suggest some late use of the central basin.

The pattern of point types and diagnostic lithic artifacts suggests some validity to the late peak in obsidian use. Of 30 such artifacts collected from the work conducted on the project, 6, or 20 percent, are thought to represent the El Paso phase. This percentage is comparable to the percentage of obsidian dates for this period (17.1 percent), but is much higher than the percentage of radiocarbon dated features (3 percent). The obsidian dates, then, may reflect the continued use of the region beyond the peak of radiocarbon dates in the early Mesilla phase. This use focused on activities involving lithics rather than those involving the production of features.

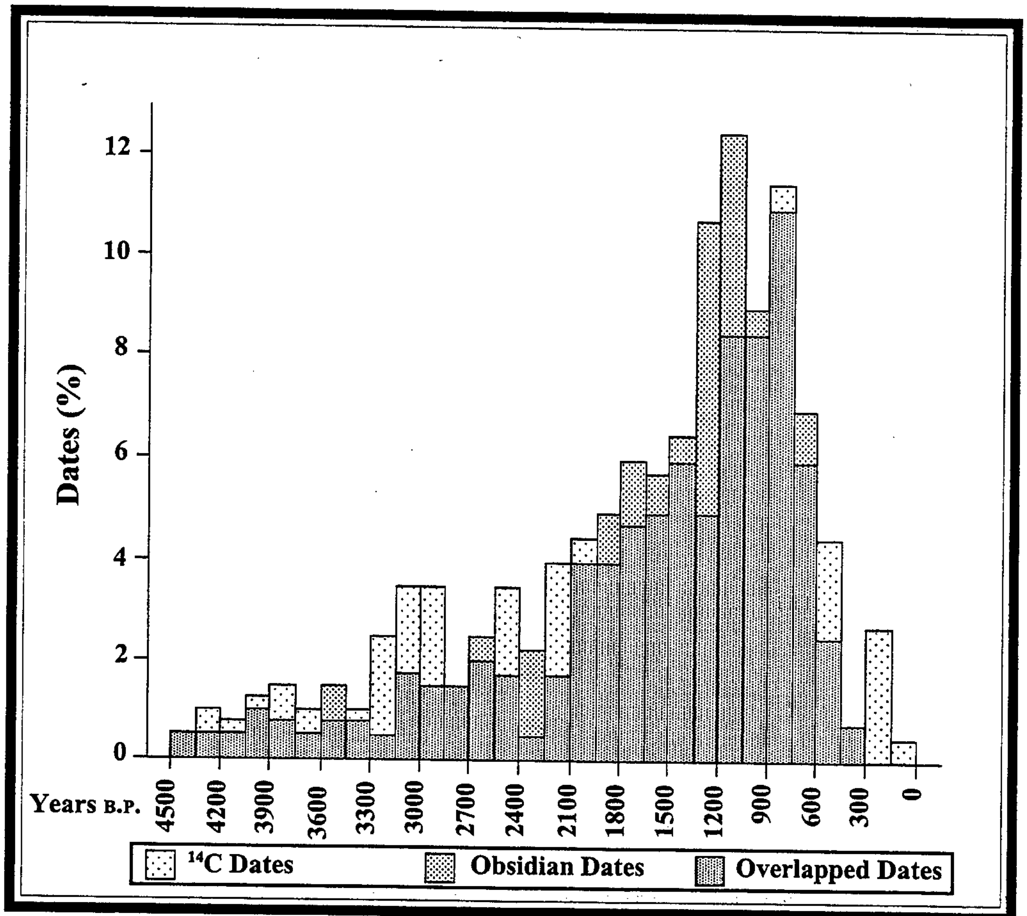

Figure 11.12. Comparison of Obsidian and Radiocarbon Dates.

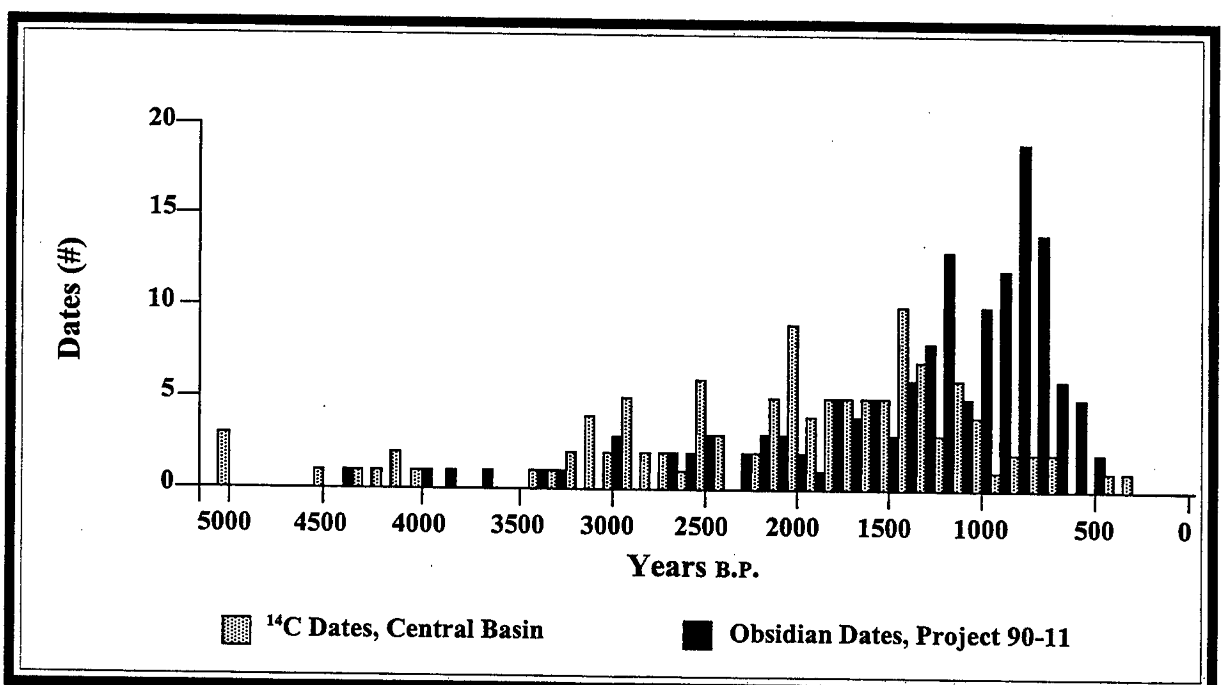

Figure 11.13. Comparison of Radiocarbon and Obsidian Dates for Central Basin and Project 90-11 Area.

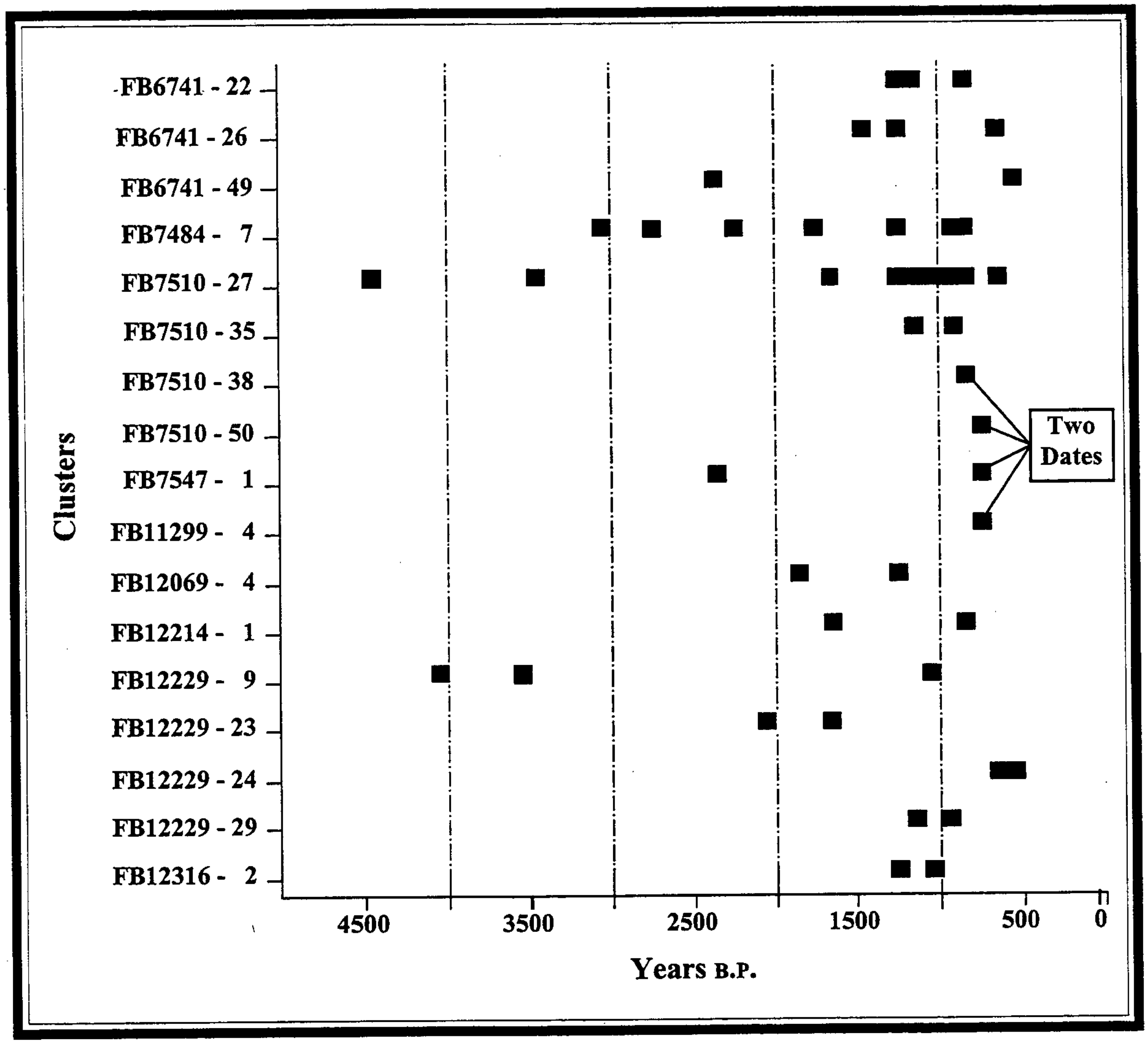

Figure 11.14. Obsidian Dates for Clusters with More Than One Date. All squares represent a single date. The "two date" designations indicate two dates are present at the same place, that is, they overlap completely.

Thermoluminescence

A third chronometric method, thermoluminescence dating of burned caliche, was undertaken, but the results of this analysis are not yet available. Appendix Q of this report lists the 22 samples submitted to the University of Missouri Thermoluminescence Laboratory. All are from features with independent dates and should provide an adequate basis for an initial assessment of the utility of this technique in the region.

Dating Analytical Units

The data suggest that when dates are available at the site level, the sites represent multiple occupations. It has been argued previously in this report that site boundaries are partially determined by survey intensity and exposure, coupled with arbitrary definitions. Two smaller spatial units, the surface cluster and the excavation block, were defined in Project 90-11. Clusters, which consist of concentrations of artifacts on the surface of sites and were defined by a cluster analysis, and blocks, which represent large areas of excavation associated with a particular set of features, are also greatly influenced by erosion and exposure.

However, they do seem to have more temporal integrity than the site level. Obsidian hydration analyses were primarily used to assign dates to surface clusters, and radiocarbon dates were used to assign dates to block excavations.

Obsidian dates, which are primarily from the surfaces of sites, provide chronological placement of 49 of the 282 clusters identified from the surface collection data (Table 11.5). Seventeen surface clusters had multiple dates from different obsidian pieces (Figure 11.14). This provides an additional opportunity to assess the integrity of the surface clusters. On clusters such as FB6741, Cluster 49, and FB7547, Cluster 1, the dates differ radically. Other clusters, such as FB7483, Cluster 7, and possibly FB7510, Cluster 27, probably had several occupations. In 12 of the 17, the obsidian dates cluster within several hundred years.

Table 11.5. Obsidian Dates on Clusters.

Site	Cluster	Cat	Rim	Latest B.P. Date	Other B.P. Dates
FB6741 (41EP1028)	19	432	5.25	1833	
	22	1,362	3.99	1283	
	22	1,851	3.56	1106	
	22	918	2.95	866	
	23	90	3.16	947	
	26	183	4.47	1487	
	26	193	3.88	1237	
	26	201	2.34	641	
	28	1,073	3.19	959	
	33	1,663	2.91	851	1587
	39	626	2.87	836	
	42	1,062	4.17	1359	1847
	49	790	6.31	2328	
	49	771	2.11	560	
	68	711	1.88	482	
	70	114	3.96	1270	
	73	157	3.12	932	
	74	1,109	3.47	1070	1250
FB7483 (41EP1037)	3	80	6.12	2237	
FB7484 41EP1034)	4	113	2.98	878	
	7	72	6.13	2242	
	7	84	5.11	1770	
	7	95	6.72	2527	
	7	37	3.96	1270	
	7	44	3.02	893	
	7	93	3.02	893	
	11	21	3.09	920	
	17	250	7.27	2799	
FB7508 (41EP982)	3	41	5.14	1783	
FB7510 (41EP978)	27	78	4.94	1694	
	27	108	8.60	3482	
	27	150	10.43	4474	
	27	111	3.65	1143	
	27	122	3.54	1098	
	27	159	3.89	1241	

(Continued on next page.)

Table 11.5. Obsidian Dates on Clusters (continued).

Site	Cluster	Cat	Rim	Latest B.P. Date	Other B.P. Dates
	27	107	3.28	994	
	27	109	2.90	847	1122
	27	506	2.38	655	2295
	35	178	3.74	1179	
	35	185	3.16	947	
	36	531	1.97	513	
	38	132	2.97	874	
	38	133	2.97	874	
	45	236	3.84	1221	
	50	255	2.65	754	
	50	484	2.60	735	
FB7517 (41EP972)	9	5	4.96	1702	
FB7520 (41EP970)	13	417	2.20	592	886
	19	383	2.51	702	
	21	169	6.78	2556	
FB7547 (41EP964)	1	477	6.37	2357	
	1	483	2.74	787	
	3	208	2.98	878	1312
	15	132	3.51	1086	1431
	18	135	7.77	3051	
FB10410	1	37	3.11	928	1367.00
FB11299	4	37	2.56	721	
	4	17	2.65	754	
	4	19	2.76	795	
FB12069	3	95	5.38	1892	2699
	4	60	5.24	1828	
	4	74	3.93	1258	2105
FB12214	1	4	4.89	1671	
	1	5	2.87	836	
FB12222	1	2	3.86	1229	
FB12229	9	38	9.59	4012	
	9	88	8.65	3508	
	9	130	3.49	1078	1401
	23	483	5.73	2054	
	23	477	4.74	1605	
	24	424	2.48	691	
	24	423	2.20	592	912
	29	643	3.67	1151	
	29	195	3.19	959	
FB12239	7	90	4.14	1346	2664
FB12243	1	29	3.15	944	
FB12247	7	11	3.42	1050	1418
FB12316	2	19	3.98	1279	
	2	24	3.51	1086	1618

Given the variability in both obsidian hydration and the regression equation, some degree of variation within clusters is expected. When coupled with problems of reuse the obsidian dates for clusters with multiple dates show some consistency. Yet, the dating results suggest that even at the smaller cluster level the assemblages may be the result of several occupations.

An additional check on the integrity of clusters compared the mean cluster date of obsidian relative to the occurrence of ceramics. Ceramics were present in eight clusters that also have obsidian dates. Six of these have average obsidian dates that fall within the Formative period. However, several cases clearly have multiple temporal events. For example, Cluster 17 on FB7484 has a single obsidian date of 2799 B.P., but the cluster also has El Paso Polychrome. Thus, while there is some validity to the obsidian dates at the cluster level, there is still considerable potential for multiple temporal events to be represented in any given cluster.

Nineteen blocks have feature-associated radiocarbon dates (Table 11.6). As with the results from the surface cluster analysis, several blocks have multiple feature dates that do not overlap, suggesting the possibility of a number of temporally unrelated occupations. In most of these cases, the feature dates are derived from only a few features. Several additional features were often present in these blocks, but lacked sufficient charcoal for a date. Thus, the actual association of any given set of artifacts within a block to a date may be in error. So, while the smaller analytical units have multiple dates and several instances of temporal amalgamation of unrelated items can be documented, the cluster and block levels do seem to have a higher degree of temporal integrity than the site level.

Table 11.6. Radiocarbon Dates from Blocks.

Site	Block	Dates B.P.
FB6741 (41EP1028)	1	559
	2	2253, 2435
FB7483 (41EP1037)	7	3275, 7159
	10	2571
	15	1435, 1527, 1540, 1354
FB7547 (41EP964)	21	1307
	23	2186
FB7580 (41EP1753)	25	1750
	26	2969, 2476, 2980
FB10411	27	635.00
FB12069	36	1410, 1521, 1466, 1295
FB12072	37	1755, 1888, 1831, 1929
FB12100	41	991, 1103, 1052
	42	1235
FB12102 (41EP4908)	48	1635
FB12225 (41EP4914)	54	3084, 3101
FB12316	62	2534
FB12330	64	1320, 1410
	65	1066

Temporal Trends in Lithic Attributes

Several researchers suggest that patterns in chipped stone assemblages are of sufficient magnitude to allow temporal placement of assemblages in the absence of chronometric dates. For example, Carmichael (1986) suggests that a change in the diversity of chert through time is of sufficient magnitude to allow the tentative placement of assemblages into temporal classes. Others (e.g., Laumbach 1980) argue that higher quality material and more emphasis on bifacial reduction characterize preceramic assemblages. Several possible trends in reduction and raw material use can be identified in the project data; however, the variability within any given time period is considerable. This high degree of variability suggests that the trends are of little utility in assigning unknown assemblages to temporal periods.

Consideration of patterns in lithic remains was primarily conducted at the block excavation level. Several blocks with radiocarbon dates and associated lithic assemblages were compared. The nature of the association, of course, is open to question, but these assemblages are more likely to be associated with the radiocarbon dates then any analysis conducted at a site level. Some surface cluster data were used for comparison using obsidian dates to place the clusters into temporally similar periods of time. However, the association of the surface cluster assemblage with an obsidian date is less secure.

After examining the range of radiocarbon dates and assemblage sizes in any given block, the block assemblages were divided into four temporal units to

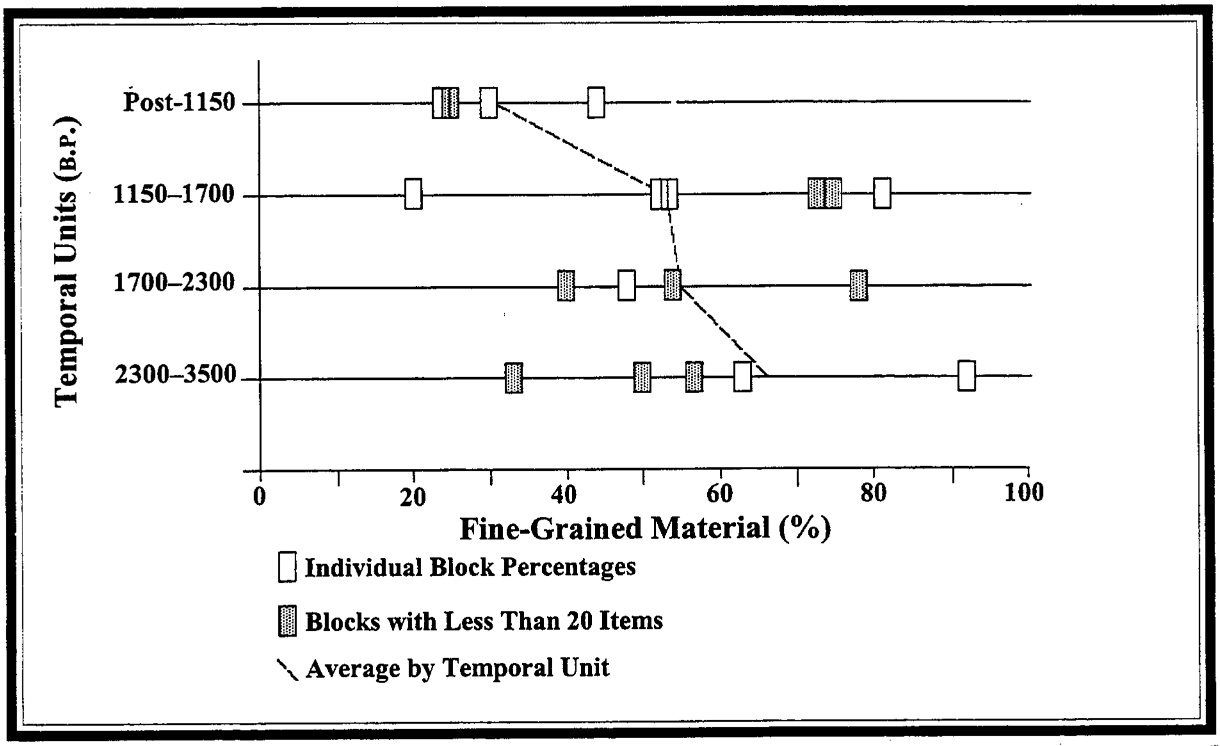

Figure 11.15. Fine-Grained Material through Time. Data is from block levels with all ranges based on radiocarbon dates.

investigate changes in chipped stone use through time. Temporal Unit 1, which consisted of four blocks with dates more recent than 1150 B.P., had a sample size of 282 chipped stone items. Unit 2, comprised six blocks with dates between 1150 and 1700 B.P. and a total sample size of 264 items. Unit 3, with dates of 1700 to 2300 B.P., was composed of four blocks with 97 items. Unit 4 had 142 items spread across five blocks with dates between 2300 and 3500 B.P. These four temporal units, then, span the late Archaic into the late Formative.

Several trends through time are apparent in aspects of the chipped stone assemblages when all block data from a given temporal unit are combined. For example, the percentage of items without cortex in the assemblages consistently decreases through time. At 2300–3500 B.P., cortex is absent on 61.3 percent of the assemblage. In Unit 3 (1700–2300 B.P.) the percentage of the assemblage without cortex drops to 55.7 percent. In Unit 2 (1150–1750 B.P.) the percentage falls to 53.4 percent, and in Unit 1 it declines to 52.5 percent. While there is no consistent pattern in raw material use for most categories, the frequency of Franklin rhyolite does seem to increase through time, from 1.4 percent in Unit 4, 2.1 percent in Unit 3, and 18.6 percent in Unit 2, to a high of 33.7 percent in Unit 1. Similarly, utilized flakes in the assemblages show some weak temporal patterns, declining from about 9 percent in Unit 4 to 8 percent in Unit 3 and 5 percent in Unit 2, but increasing to 6 percent in Unit 1. There is no consistent pattern in the medial-distal thickness measurements or in the percentage of multifaceted platforms through time.

Temporal changes in surface clusters are not as apparent as in block cases. Surface material was divided into four temporal continuum units, but these units differed from the block level distinctions. The first unit included materials from clusters with obsidian hydration dates within the last 700 years. The second unit encompassed the 700–1100 B.P. range. The third unit included assemblages associated with dates from 1100–1700 B.P. The fourth unit included all material prior to 1700 B.P.

As was apparent in the block data, the cluster temporal units seem to have a decreased frequency of utilized flakes, dropping from 11.1 percent in Unit 4 to 8.1 percent in Unit 1. Similarly, the use of fine-grained and very fined-grained materials seems to have decreased through time. The Unit 4 (pre-1700 B.P.) assemblage has 64.6 percent fine-grained and

very fine-grained specimens. This is followed by an increase in Unit 3 to 72 percent and a decline to 45.9 percent in Unit 1. As with the block level patterns the percentage of multifaceted platforms and the medial distal thickness show no temporal patterning.

Some data suggest limited directionality in the percentage of utilized flakes in the assemblages, the use of fine-grained and very fine-grained materials, cortex percentages, and possibly some specific raw material change. However, there is also considerable variability within any given temporal unit (Figure 11.15). The overall average percentage for a given temporal unit shows a decrease through time. The strength of this decrease is one of the stronger temporal patterns identified. However, considerable variability within any given temporal unit is evidenced by the spread of the individual blocks. Some of this variability is related to small sample sizes in several blocks. The variability is still significant after eliminating these low sample size cases and recognizing the general trend of a shift away from fine-grained and very fine-grained raw materials.

It is unlikely that it is possible to assign any unknown block to a temporal period based on the percentages of fine-grained and very fine-grained materials. While the overall trends suggested by previous researchers are present in varying degrees in these assemblages, there is substantial variation within a period.

Summary

This chapter reviewed the chronometric data from Project 90-11. Radiocarbon dates from features on the project suggest a principal use of the study area during the late Archaic and into the early Formative period. Comparisons to a basin-wide sample of dated features confirms the fluctuating but increasing use of the central basin between roughly 3200 and 1350 B.P. After this period of peak use, the frequency of feature dates declined. A comparison of feature dates in the basin with a large regional sample of dated features clearly suggests a decreasing frequency and eventual abandonment of the central basin for activities involving features after 1350 B.P.

A regression technique to assign dates to obsidian rim widths identified a pattern of increasing use of obsidian in the central basin several hundred years after the decline in feature use. These dates suggest that the central basin continued to be used after 1350 B.P., but that the type of use shifted.

The date ranges for any given site suggest a high level of reoccupation. Any analysis comparing site by site level attributes seems unwise given the high frequency of reoccupation. However, dates were assigned to several intrasite surface clusters using obsidian hydration and to several excavation blocks using radiocarbon dates on features. It was then possible to consider temporal patterns in various lithic attributes suggested by previous research to change through time in predictable ways. Although several changes in both surface cluster and excavation block assemblages that may have temporal utility were identified, the variability in these attributes within any given temporal unit was substantial. This magnitude of variability makes any assignment of undated blocks or clusters to temporal periods based on these general trends untenable.

Chapter 12

ADAPTIVE CONTEXTS

A principal goal of Project 90-11 involved developing an understanding of the roles or adaptive contexts represented by components in the project area. As with functional and chronological concerns, this investigation was initially structured at the site level. The adaptive context refers to the role played by an occupation in the regional settlement system. It does not necessarily refer to function or activities conducted. Two occupations may center on the same activities, for example, mesquite collection, yet represent different adaptive roles. One may represent a logistical organization in which task groups were involved, while another may reflect a foraging organization. Adaptive role, then, refers to how these occupations were organized with respect to other occupations in the region.

Several terms are used to discuss different components and their place in an adaptation. *Residential* occupations are those at which some minimal component of a population, such as a family or series of family units, lived for a length of time, usually one night or more. Residential sites can be either *foraging based* (supplied primarily by daily inputs of subsistence and material), *logistically based* (supplied primarily by storage of subsistence and material amassed at a location or supplemented by large inputs at irregular intervals), or some combination of the two strategies.

Logistical occupations refer to locations that were used in the collection and processing of large quantities of material primarily for storage or transport back to residential areas. These may have involved varying group sizes and lengths of stay, but the primary focus was not on daily collection and consumption of resources or on the use of stored remains, but on the collection of material for transport or storage.

Special purpose occupations refer to locations focused on aspects other than residential and logistical occupations. This is a catchall category that includes hunting stands, material caches, and other locations that do not fit into either the logistical or residential group.

Finally, *extractive activity* occupations are extremely short-term locations away from more permanent sites. They were, essentially, the foraging component of a residential foraging occupation. They include the material remains generated by activities such as collecting plant and animal materials for daily transport back to a foraging base for consumption. The remains generated by any given extractive event may be no more than a single flake, and many extractive activities probably left no material remains.

Identifying Adaptive Roles

Previous survey and excavation projects in the area have built typologies of sites to analyze site distributions against ecological zones and to consider shifts through time in settlement and subsistence patterns. The most frequently used approach in developing a site typology involves defining a set of criteria to identify different types of sites. The criteria change from researcher to researcher but they usually involve some combination of site size, artifact variety, feature numbers, or site characteristics as distinguishing criteria.

Anderson (1993) essentially uses MacNeish's (1983) microband/macroband/task group typology. The major defining criteria involve the presence and number of features: sites without features are task groups; sites with fewer than three features are usually microbands, and sites with more than three features are usually macrobands. Carmichael (1986) uses the presence of middens as a defining criterion for residential sites. Whalen (1977, 1978) uses a combination of site size and artifact variety to identify small camps, large camps, hamlets, small villages, and large villages.

These various schemes are in some sense reasonable. The researchers involved often are working with survey data, and the schemes represent attempts to investigate relatively complex data sets. Yet, each of these reasonable approaches produces

radically different pictures of the archaeological record. For example, using Carmichael's criteria for identifying residential sites, none of the sites in the Project 90-11 survey area qualify because they all lack middens. Using Anderson's criteria the vast majority represent fairly large macrobands. Applying Whalen's criteria the sites are small camps, large camps, hamlets, small villages, and large villages. Such radically different pictures based on the same data reveal nothing about past organizations, but much about ambiguities and problems with the way typological schemes are developed in the present.

The problem centers on the use of definitions. If Anderson (1993) is correct in assuming that all task groups do not use hearths and that microbands usually have three or fewer hearths, a variety of processes can alter these characteristics for a given occupation. These processes include scavenging, reoccupation, and erosion, all of which are present in the current study area. The processes may result in patterns of features and artifact variety that do not reflect adaptive differences. Calling a site that lacks features a task group all but guarantees that the processes can be ignored.

Most typological schemes rely on some combination of artifact or feature variety (see Carmichael 1986; O'Laughlin 1989; Whalen 1977, 1978). However, several researchers have shown that sample size can greatly influence variety measures (Jones et al. 1983; Kintigh 1984; McCartney and Glass 1990; Rhode 1988). As the number of items recovered increases, the probability of recovering different types of items increases. Mauldin and Graves (1991) demonstrate a strong correlation between number of features, site size, number of artifacts on sites, and number of different types of artifacts in the project area. This earlier analysis demonstrated that these relationships, once corrected from nonlinearity, all had a Pearson's correlation coefficient of more than .6, with assemblage size and site size having a Pearson's R of .88, and the number of features and site size having a correlation coefficient of .90. Developing a useful scheme for identifying types of sites becomes complicated when this observation is combined with the high incidence of reoccupation shown for some sites in the study area, the effects of transect spacing on what is initially defined as a site, and the influence of deposition and erosion on site boundaries.

Different types of occupations are defined from a perspective of the role they played in the overall adaptation rather than by reference to any specific attribute. Thus, when an occupation is identified as residential, the concern is with the role the occupation played. Residential sites may not have true structures, may not have middens, may be quite small, and may not even have more than a handful of artifacts. For example, Yellen (1977), working with the !Kung San of southern Africa, identified 16 sites used as residential bases. These camps were composed of a few scattered hearths, a few structures that quickly deteriorated, and generally less than 10 nonperishable artifacts. He concluded that it is "most likely that none but the largest !Kung dry-season camps would be found by . . . archaeologists" and that none of the smaller, rainy-season camps would be uncovered during survey (Yellen 1977: 80; see Nicholson and Cane 1991 and Tanaka 1980 for other examples).

The archaeologically discoverable traces of these residential sites, which were essentially foraging based, were a few features and less than 10 artifacts for any given occupation. They did not have middens or a wide variety of artifacts, and often lacked evidence of structures. Yet, these sites were clearly residential in that they represented occupations by a series of family units over several days during which foraging activities were conducted on the landscape. Much of the activity associated with these sites occurred not at the residential location, but in an area around the site in the foraging radius. Site activities were limited to daily preparation and consumption activities, and possibly to some low-level tool preparation and maintenance activities. The foraging activities that occurred away from the residential sites sometimes generated features, but more often resulted in the deposition of a few artifacts at various locations. These would be classified here as extractive activities.

At the other extreme, logistical locations, when seen in an archaeological context, may contain the remains of structures and middens, occur over large areas, and generate many artifacts. Binford (1983: 117–138) provides several examples of these types of sites for the Nunamiut of Alaska. Though these sites generated a substantial quantity of artifact remains, they were logistical in that most processing was not for immediate consumption, but rather for transport or storage. Processing activities characterized the sites, with consumption activities related to the demands of the task group.

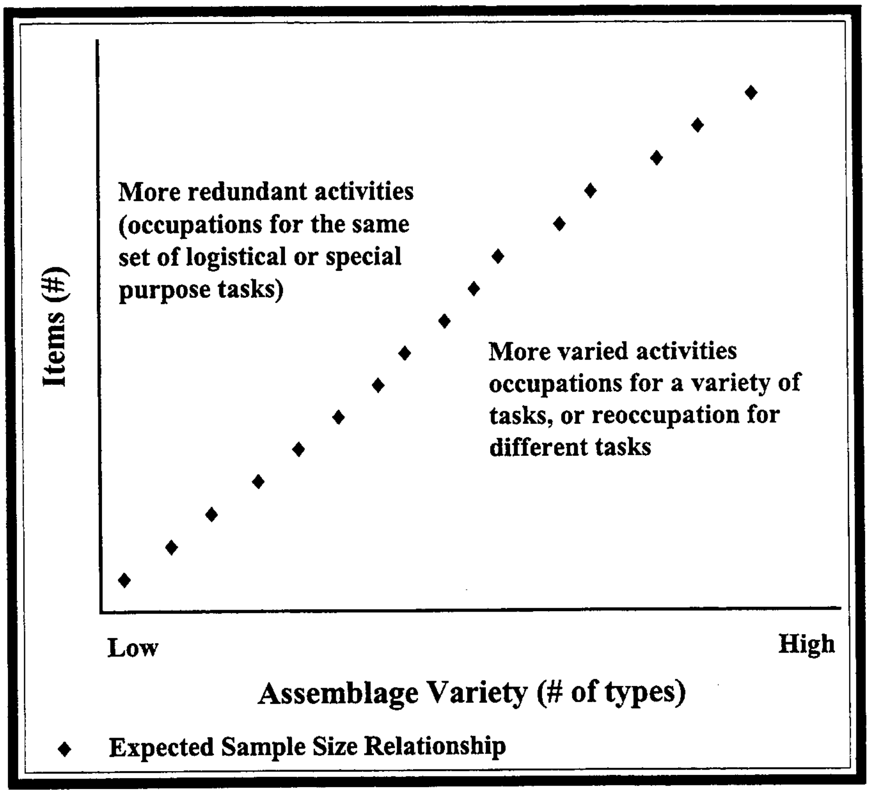

Figure 12.1. Expected Artifact Variety, Assemblage Size, and Activity Variety.

How are these roles recognized in the archaeological record if the role played by an occupation can be represented by a wide range of material remains, and if the same set of remains reflect a variety of adaptive roles? It is likely that any satisfactory result will ultimately require working at several different spatial and temporal scales, and the investigation in the Project 90-11 area began by exploring relationships between artifact variety and quantity.

Investigation of relationships between artifact variety and quantity was an attempt to measure task variety. Ignoring reoccupation for a moment, the distinction between logistical and residential sites becomes a question of task variety, with residential occupations having a variety of tasks and logistical occupations having a limited number. Three propositions guided exploration of artifact variety. First is the assumption that as the number of items (assemblage size) increases, the variety of items should increase. Several authors document this relationship in the archaeological literature (Bobrowsky and Ball 1989; Jones et al. 1983; Kintigh 1984; Leonard and Jones 1989; Rhode 1988; Thomas 1983). Second, on sites in which artifact totals are the result of more varied activities, the rate of increase between sample size and artifact variety should occur faster; new types of items should be added to an assemblage quicker relative to the overall assemblage size. Finally, on sites with redundant tasks, new items are added to an assemblage at a slower rate (Thomas 1983). Figure 12.1 shows these expectations for the number of items and the number of different types of items. Points falling above the expected regression line should have a higher variety of activities represented while points below the line should be characterized by greater redundancy.

The range of activities at a location, which results in the deposition of artifacts, can be related to different adaptive contexts represented by the sites. On residential sites, the expectation is that a greater variety of activities will be conducted, and these sites should fall in the lower range of expected artifact variety. Special purpose locations, conversely, occupied for the same range of tasks, should fall in the upper range. However, a variety of special purpose occupations could occur at a single location. The site may then appear to be a residential location, when, in fact, it simply represents a variety of special purpose

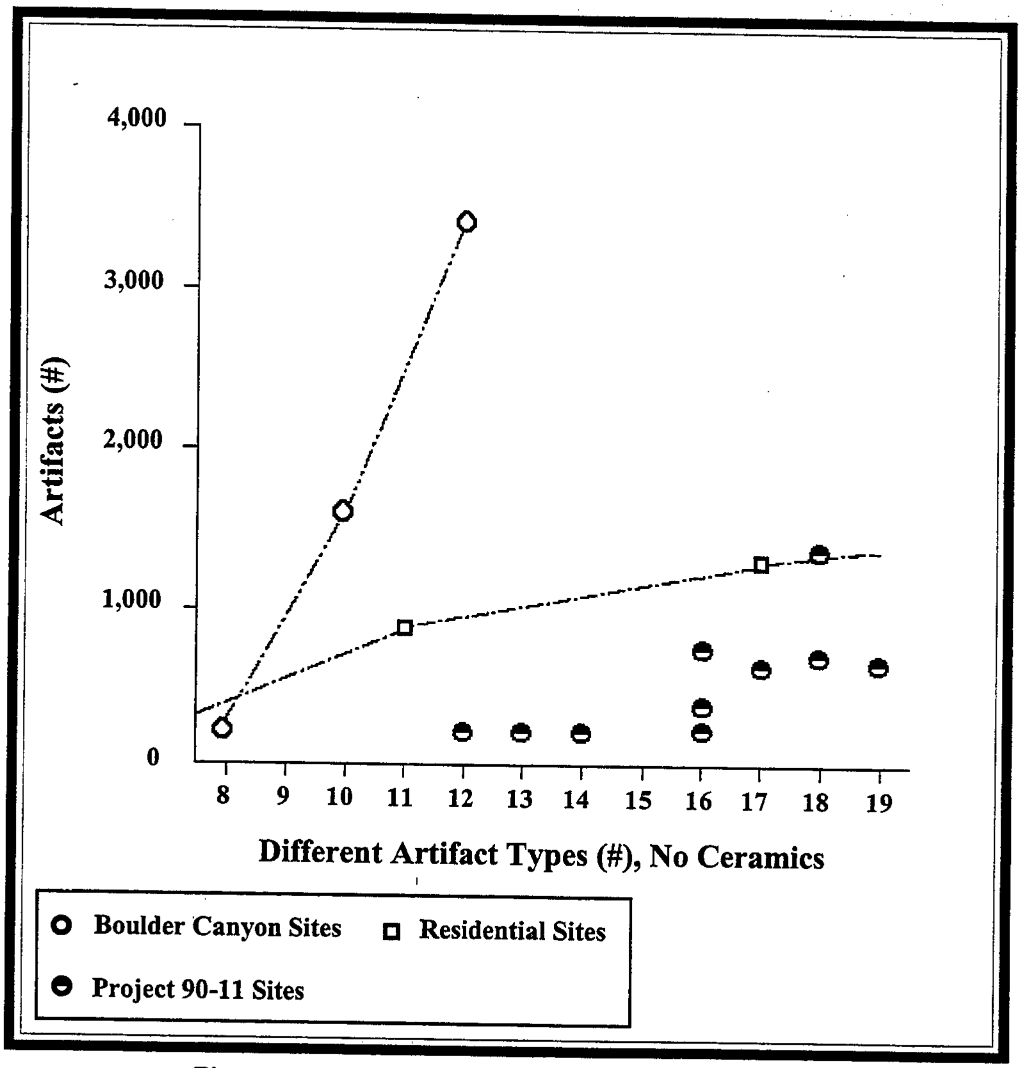

Figure 12.2. Artifact Quantity and Variety Relationships.

components compounded by reoccupation for different tasks.

Figure 12.2 presents a series of cases comparing artifact variety and quantity from several excavation projects in the area. The Boulder Canyon sites (Lukowski and Mauldin 1995) lacked recognizable features and consisted primarily of lithic artifact scatters. Based on the range of point types, the sites were repeatedly occupied, with most occupation occurring during the late Archaic through the early Formative period. The assemblages making up the residential line are from FB46, the Conejo site (Hard 1986?), and Meyer Pithouse Village (Scarborough 1986). Both had multiple pit structures, extensive trash deposits, and appeared to represent a few, closely related occupations. Meyer Pithouse Village is well dated to around 1200 A.D., while Conejo dates between 600 and 800 A.D. The separation between the two curves clearly conforms to the expectations presented in Figure 12.1; the Boulder Canyon assemblage profile suggests a special purpose location, while the other two sites have a residential profile.

The final group of sites in Figure 12.2 represents site level data from the larger Project 90-11 assemblages. A variety of different occupations are collapsed into a single value for comparative purposes because the sample size associated with any given surface cluster was not adequate for comparison. Sites in the project area represent a wide variety of tasks. This is the expected pattern either for residential occupations or for different special purpose occupations occurring in the same place. How-

ever, none of the site level assemblage falls anywhere near the single special purpose curve identified for the Boulder Canyon assemblages.

Whatever these sites represent in terms of organization, the patterns of artifact number and variety suggest a variety of activities. However, by themselves, the patterns do not exclude the possibility that the site level assemblages represent a variety of special purpose occupations. The pattern is compatible with either a residential focus or a series of special purpose occupations geared to the exploitation of different resources.

Cluster Level Patterns

To explore further the artifact variety and quantity relationships in the project data, project personnel considered patterns at the level of the 282 clusters identified for the surface material. Clusters are frequently the result of multiple occupations and are determined to some extent by erosional characteristics, but they have a higher probability of reflecting single occupations.

Unfortunately, comparative data for clusters was not available as it was for the larger site level analysis. In an attempt to solve this problem, expectations for smaller sample sizes were generated using a random selection procedure and repeatedly drawing 110 samples ranging between 10 and 175 items from the residential sites (Meyer Pithouse Village and Conejo) and 110 samples with similar quantity limits from the special purpose sites (Boulder Canyon). The number of types in a sample was contrasted with the overall sample size (Figures 12.3 and 12.4).

The curves have different slopes, with residential sites having more types for a given sample size than the special purpose assemblages. For example, the regression equation for special purpose sites predicted six artifact types with 83 artifacts on task sites, and the equation for the residential pattern predicted six artifact types with 70 artifacts. In small samples the differences between the two curves are present; however, a close consideration of the ranges in the number of types in any given sample size suggests that the differences between the curves are not of sufficient magnitude to allow clear separation.

Figure 12.5 presents artifact variety and quantity relationships for the 282 surface clusters in the project area. Several clusters have large samples and a small number of types, but the vast majority have a high variety of types relative to sample size. Interpreting these smaller sample sizes in terms of the residential and special purpose pattern is hampered by the lack of any clear cut pattern (see Figures 12.3 and 12.4); most clusters appear to follow more closely the residential curve. Six artifact types with 70 artifacts were predicted on residential sites; however, most clusters with six artifact types have sample sizes well below 70. As the cluster level pattern is less likely to represent multiple occupations than the site level analysis, the continued presence of high variability suggests a residential rather than a special purpose focus for most clusters.

Three cluster groups shown in Figure 12.5 are defined by comparisons with Figures 12.3 and 12.4. Group 1 has a lower number of artifact types relative to their sample size. The six clusters in this group fit the special purpose category shown in Figure 12.1. Group 2, which consists of 211 clusters, contains artifact number and type relationships similar to expectations for residential occupations. Finally, Group 3 represents clusters that contain only ceramics or have ceramics and one other artifact type. This group could contain both special purpose locations and residential clusters, but separating them at this small sample size is impossible. The 65 clusters represented in this group seem to follow the special purpose pattern, though they may also represent residential use.

If these group characterizations are somewhat accurate, differences in the assemblages represented by these groups might be expected. A fourth group consisting of artifacts on sites that were not grouped into clusters was considered using chipped stone data because of its larger sample size. There is no necessary connection between the specific attribute patterns on the chipped stone or the overall assemblage type breakdown and the cluster definitions or the assignment of any given cluster to a group.

Table 12.1 presents the chipped stone artifact assemblage composition of the four groups. The percentage of formal tools is, in general, much more common in Group 0—assemblages not associated with clusters—and is dramatically underrepresented in Group 1, one of the special purpose classes. Using only Groups 0, 1, and 2 (Group 3 lacked most artifact categories), projectile points were more common in

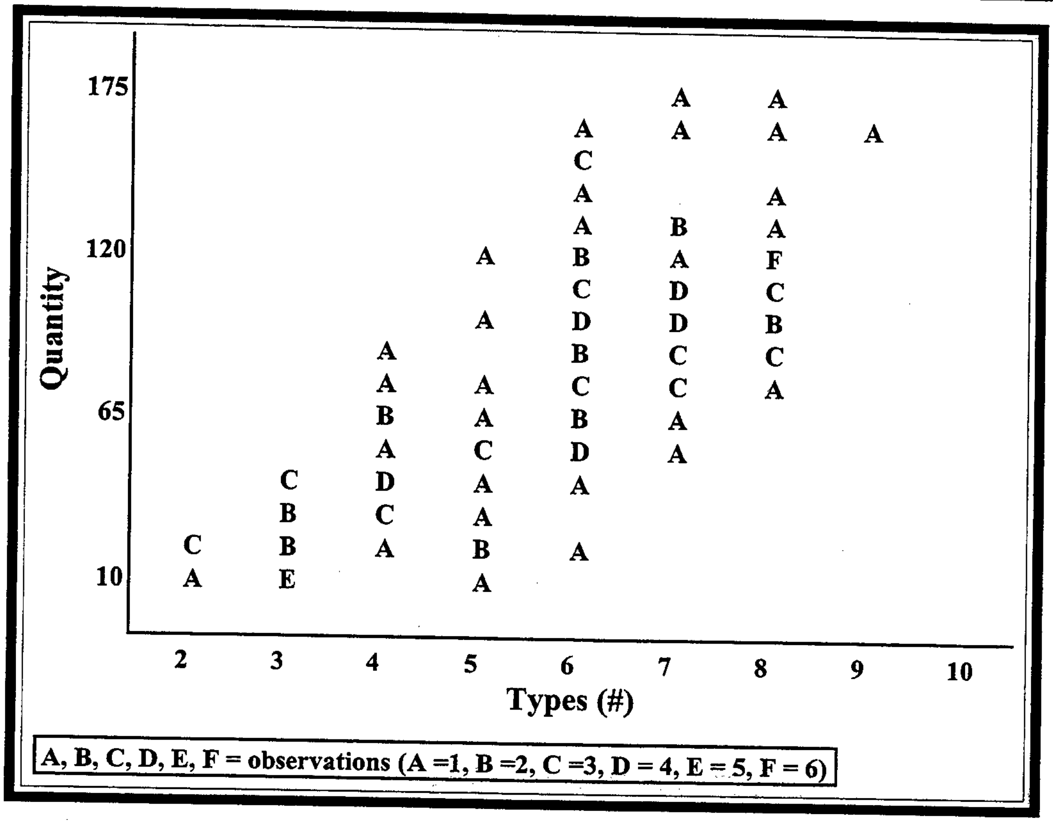

Figure 12.3. Artifact Types in Special Purpose Assemblages (repeated random draws from large special purpose assemblages).

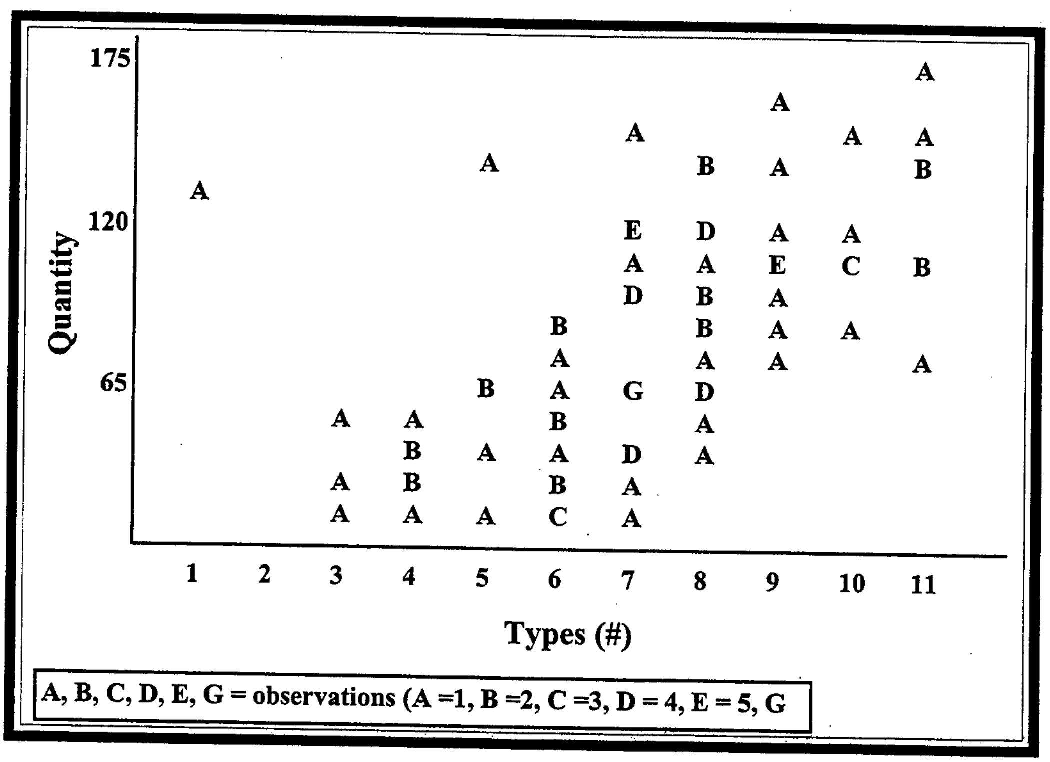

Figure 12.4. Artifact Types in Residential Assemblages. (repeated random draws from large residential assemblages).

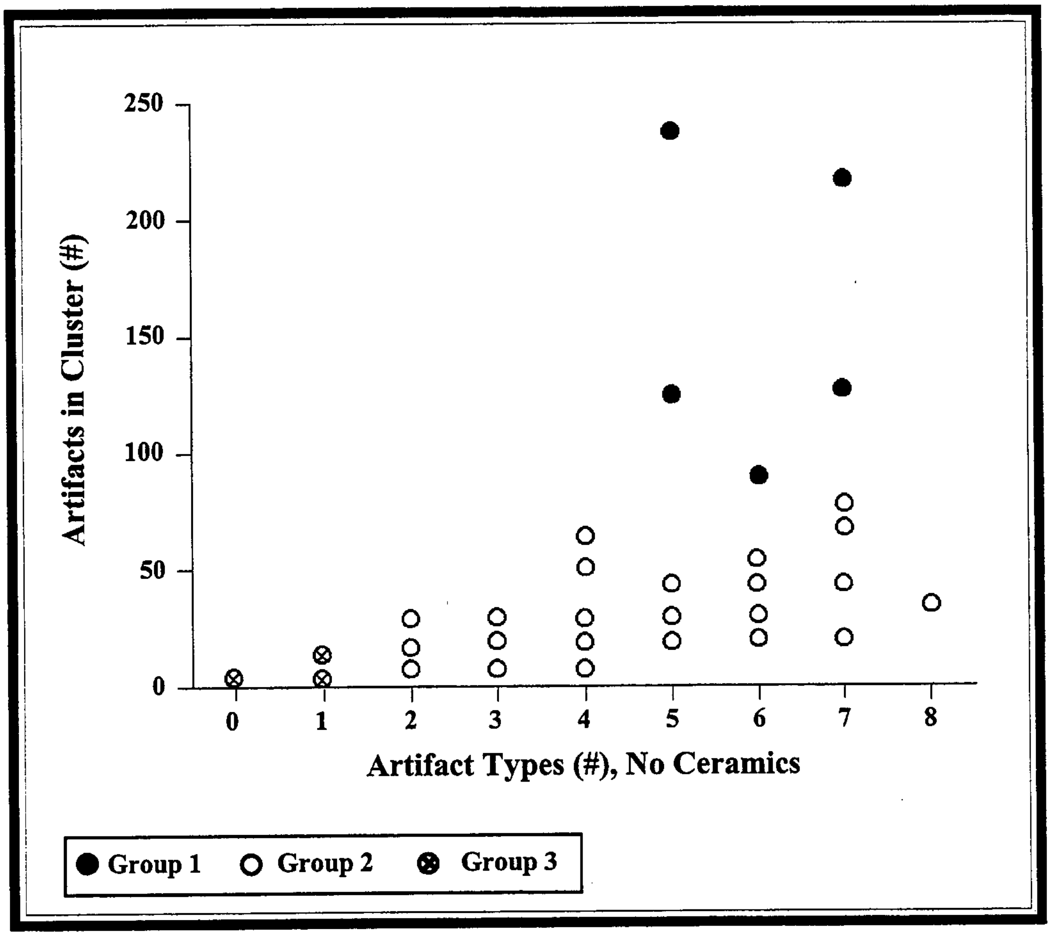

Figure 12.5. Artifact Variety and Quantity in Clusters (N = 282; several cases at any given symbol).

Group 0 (N = 10) than Group 1 (N = 1); conversely, bifaces were more common in Group 1 (N = 10) and slightly less in Group 0 (N = 9). Informal tools were more common in Group 0 and Group 2, and less common on Group 1. However, the Group 1 informal tools were generally of higher quality material than in either Group 0 or Group 2 clusters. Finally, Group 1 clusters had a low frequency of "true" hammerstones, and no ground stone hammerstones. Group 2 and Group 0 have both classes of hammerstones represented in roughly equal proportions.

Thus, flakes seem to dominate the Group 1 assemblages, with only bifaces being more common than expected. In part, the original classification system determined the low variety of different artifact types. That is, Group 1 clusters, by definition, have a low variety of different types. However, the

original classification does not determine the patterns within the formal tool category or explain the slightly higher frequency of bifaces in Group 1 clusters.

Patterns in medial-distal fragment thickness, the quality of raw materials in flakes, platform attributes, and the percentage of cortex on flakes suggest that formal tool reduction rather than a focus on core reduction characterized Group 1 clusters (Figure 12.6). The Group 1 assemblages had a higher percentage of multifaceted platforms, much higher percentages of high quality raw materials, and a high percentage of flakes without cortex. The median and interquartile ranges on medial-distal fragments were significantly smaller than the other three groups. All patterns are consistent with reduction related to producing formal tools. The Group 1 lithics, then, suggest a focus on formal tools, though with the exception of bifaces, formal tools are under-represented.

Table 12.2 presents summary information on the clusters compiled at the group level. Although the larger sample sizes in Group 1 are not unexpected given the patterns in Figure 12.5, this group also has a substantially larger average area, and a higher average number of features. Significant differences are also apparent in chipped stone and ceramic density. Artifact density is substantially higher in Group 1, with one artifact recovered for every 3.3 square meters of cluster area. This contrasts with one artifact for every 11.3 square meters of area in clusters forming Group 2.

Features, which were not used in the original classification scheme, have a different pattern. Feature density on Group 1 clusters is 0.003 per square meter, or one feature for 314 square meters of cluster area. Group 2 has a feature density of 0.009, or one feature for every 106 square meters.

Finally, Group 1 has an extremely low frequency of ground stone. Only 28 ground stone items were recovered (density of 0.009 per square meter). This contrasts with a density of 0.02 per square meter in Group 2 clusters. This substantial difference is related in part to differences in feature density, as most of the ground stone is reused in features.

Differences in artifact variety and artifact quantity relationships at the cluster level hint at differences in task variety. Group 2 clusters have patterns consistent with residential occupations, or a series of different limited activities that have been collapsed or conducted at the same location. Group 1 clusters have patterns that suggest a more limited range of tasks. The Group 3 patterns are more difficult to interpret because of their low sample size; however, they may represent a different focus from either Group 1 or Group 2 patterns.

Analysis of artifact and feature data within each of these groups suggests that debitage indicating formal tool reduction characterizes Group 1 occupations, but the assemblage has a low occurrence of formal tools with the exception of bifaces. Formal and informal tools seem not to occur with clusters, but rather are more frequent at a landscape level. Group 1 clusters also have an extremely low feature density and little ground stone. These artifact and feature patterns are consistent with a limited activity focus, one in which tool reduction is the principal activity. The Group 2 artifact and feature patterns are consistent with the residential assignment at a general level. Features are common, assemblage sizes are small, and the debitage suggests no single focus of activity. While clusters in this group contain the remains of a variety of activities, and may contain a variety of different organizational structures, a residential organizational structure is probably present. The Group 3 patterns suggest a special purpose organization, but one that is clearly different from the Group 1 clusters, or a very short-term residential focus. The feature and artifact densities are comparable to Group 2. By definition, clusters in this group often contain ceramics.

Table 12.2. Group Level Attributes.

Group	Number	Average Features	Average Area	Average Artifacts	Chipped Stone/ Ceramic Density (sq. m)	Feature Density (sq. m)
1	6	1.50	512.0	154.0	0.30	0.0030
2	211	1.34	142.0	12.6	0.09	0.0090
3	65	0.70	70.3	9.2	0.13	0.0094
Total	282					

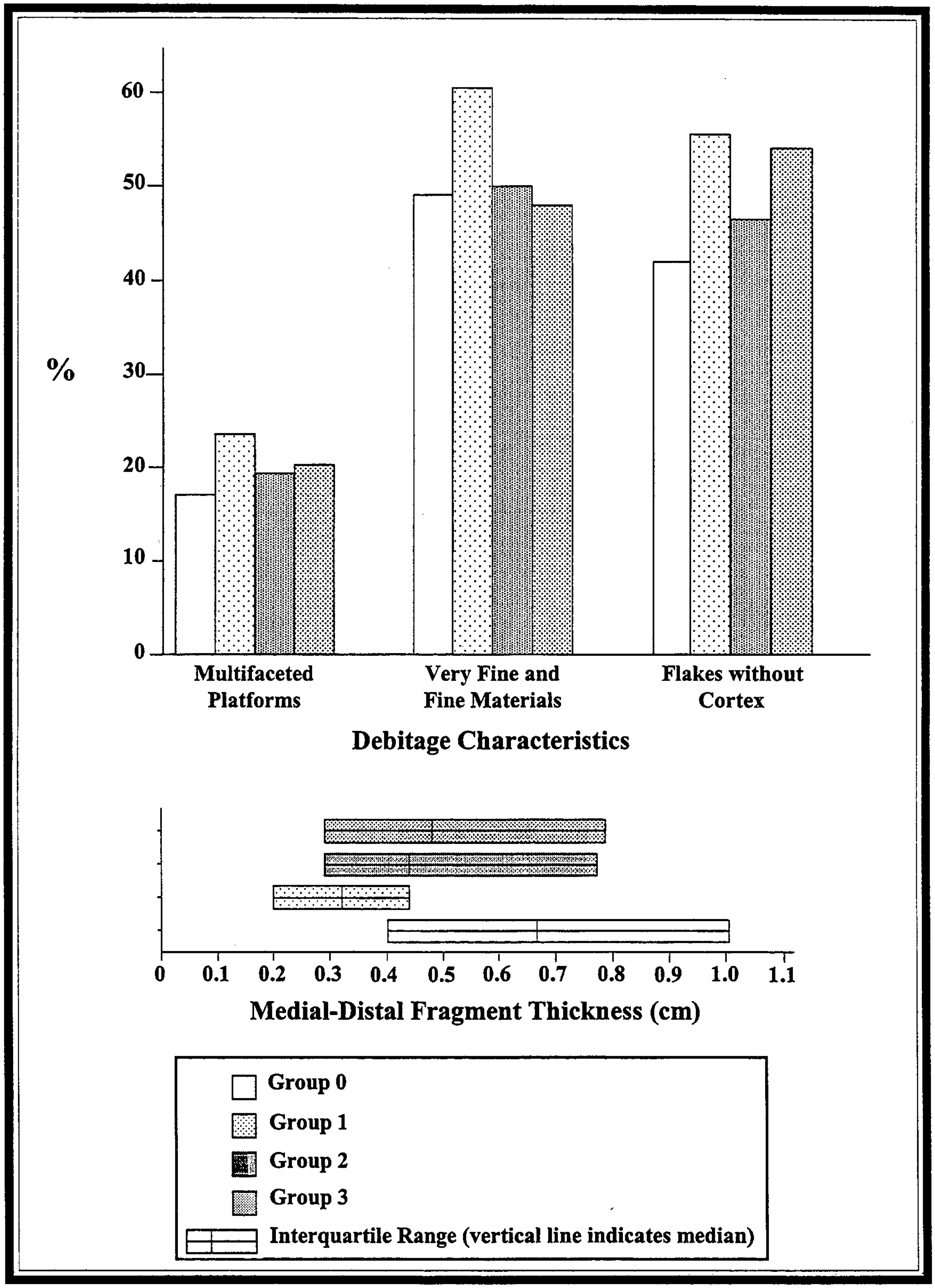

Figure 12.6. Debitage Characteristics by Groups.

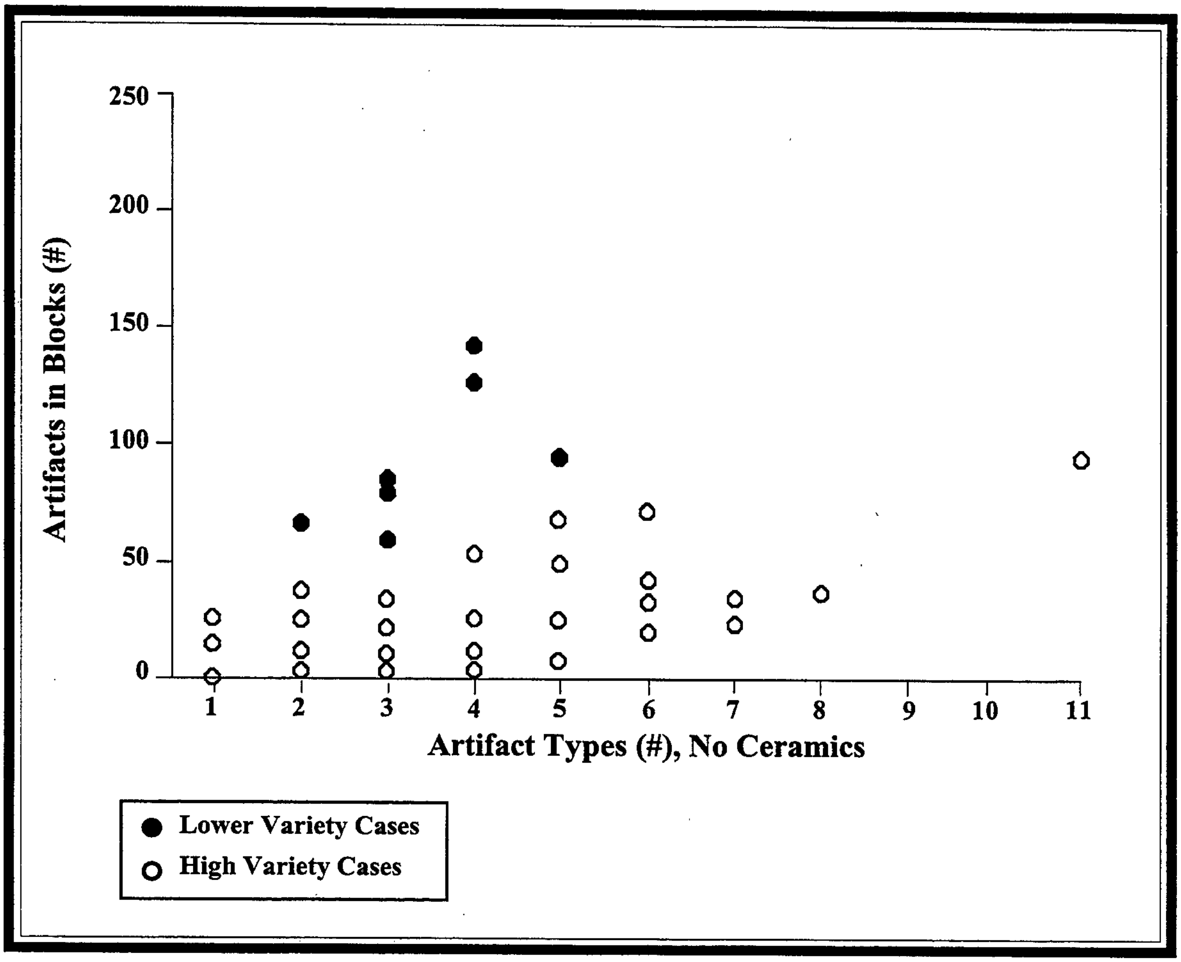

Figure 12.7. Artifact Variety and Quantity in Blocks (several cases at any given symbol).

Block Level Patterns

Figure 12.7 presents patterns of artifact variety and number for the 66 block excavation areas of the project. Seven blocks have higher than expected relationships between artifact variety and artifact number. These may represent the same pattern of special purpose or logistical occupations.

Analysis of the debitage suggested that a focus on formal tool reduction may characterize these cases, but the patterns were not as clear cut as they were in the surface assemblages. For example, 62.4 percent of the flakes lacked cortex, compared to 50.4 percent for the remaining blocks, and the medial-distal fragments were generally smaller (median of 0.20 to 0.25). However, patterns in both the use of high quality materials and the occurrence of multi-faceted platforms were essentially the same between the two block groups. Thus, while these low variety assemblages may reflect formal tool reduction, the pattern is not as clear cut as on the surface cluster analysis.

Flakes dominated the seven cases with lower than expected variety. Utilized flakes accounted for 3 percent of this group and formal tools only 0.5 percent; only a single core was recovered. In contrast, utilized flakes made up 5 percent of the remaining block assemblages, with formal tools accounting for 3 percent and cores accounting for 4 percent. As with the clusters, the lower frequencies of formal tools, utilized flakes, and cores were not unexpected because lack of variety defined the groups. However, the recovery of only three formal tools and one core out of 650 items in these seven blocks suggests that they were considerably different from the remaining blocks.

Upon comparing features in the block excavations with low variability of the remaining blocks, the distinctiveness of this low variety group was even more apparent. Three of the four probable pithouses were in the low variability class. Feature 16 on FB10411, Feature 7 on FB12330, and Feature 16 on FB12069 all had patterns that fit the logistical/special purpose [*sic*] variability model. Thus, while this group accounts for only 10.6 percent of the 66 blocks, it contains 75 percent of all probable structures. Only one structure falls in the residential artifact variety pattern.

At first glance, this pattern is counter to expectations because several special purpose or logistical sites have houses, a feature type usually thought to reflect residential use. However, residential sites will not necessarily have structures and logistical sites can have structures present. It is interesting in this regard to contrast attributes of the three probable structures that had assemblages that fell in the low variety area with the one structure that had a residential assemblage.

Two of the four house features uncovered on the project could be assigned only as probable. Feature 16 on FB10411 was only tested and was discovered in the wall of a test trench. It appeared to be quite small and basin shaped in profile. The second probable structure, Feature 16 on FB12069, had no formal outline or consistent depth and may have been little more than a shade. Both structures had the low variety artifact pattern. The third house with the low artifact variety pattern is Feature 7 on FB12330, which was clearly a house. It was circular, had a central posthole, and was roughly 30 centimeters deep. One internal feature, a burned area on the floor, probably represented a hearth location. Yet, the house was extremely small with a total floor area of only 2.7 square meters. A comparison of this floor area with 64 other pithouses throughout the Jornada region produced only four cases with smaller floor areas, and all four are outside the central basin.

The single house that fits the residential pattern of artifact variety is Feature 27 on FB12100, which is different from the previous houses. It has a floor area of 8.1 square meters, an average size range comparable to other central basin structures. It also has 17 identified internal pits. Some may be either postholes or the result of rodent disturbance, but most are clearly internal pits related to the occupation of the structure. The structure also had evidence of a cleared outside area to the east and two large external pits.

The three probable structures had low artifact variety assemblages and were generally small and ephemeral. The single structure with a residential pattern of assemblages was clearly different. The high frequency of structures with special purpose assemblages may not be in conflict with the classifications based on artifact variety, given the nature of these structures.

Patterns in artifact variety and assemblage size at both the surface cluster and the block level appear to be evidence that a high percentage of occupations may be related to a residential use of the central basin. Yet, in both samples a group of clusters and blocks is identified that may reflect logistical use of the project area.

Noncluster and Isolated Assemblages

Although most of the clusters and blocks fit a residential pattern, a large quantity of material, both within site boundaries and outside sites, is not incorporated in clusters. Of the surface chipped stone data, for example, 21 percent occurred on sites but not in sufficient densities to be designated a cluster.

No units in the noncluster and isolated assemblages were comparable to the cluster or block level analysis. Therefore, it was impossible to make comparisons similar to those of the cluster and block assemblages. However, these noncluster items had a very different character from the clusters with a higher percentage of formal tools, informal tools, and cores. The flakes had cortex, medial-distal fragment thickness, and material use patterns that suggested they were not focused on formal tool reduction; yet, they had a greater than expected frequency in noncluster assemblages. Unifaces and points were more frequent than expected in nonclustered settings, and bifaces were more common in clusters. These deposits, then, were probably associated with different activities, and may represent different adaptive components.

This pattern may represent the use of the landscape for extractive activities. Extractive use generally would not have involved feature produc-

tion, but should have resulted in the deposition of low-density material across a landscape. These deposits may well have a higher proportion of tools with utilized flakes and cores resulting from the production of expedient tools associated with the extraction of resources, as well as more formalized tools associated with the exploitation of targeted resources. These types of deposits may have been generated both from residential occupations in the area and residential occupations outside the area.

As a final point in the exploration of these noncluster assemblages, the occurrence of chipped stone artifacts was compared in cluster and noncluster settings relative to the three landform distinctions (Table 12.3). Eighty isolated chipped stone items were not included in this analysis because, given the small sample, they should not significantly affect the patterns. Nonclustered artifacts were much more common than expected in both the northern area and along the playa ridge, while they were lower than expected in the southern area away from the playa areas. Although a number of processes other than prehistoric behavior were involved both in the creation and discovery of clusters, the patterns suggest that extractive activities associated with the production of off-cluster material may have been greater along the playa ridge and in the northern zone.

Table 12.3. Chipped Stone Artifacts in Cluster and Noncluster Settings by Landform.

	Noncluster		**Cluster**	
Landform	**Actual**	**Expected**	**Actual**	**Expected**
North	99	43	87	143
Playa Ridge	461	365	1,104	1,200
South	511	661	2,328	2,178
Total	1,071	1,069	3,519	3,521

Finally, a component of some clusters may be related to this broad scale land use activity. There is no reason to think that clusters are completely free of the deposition of artifacts from this additional, adaptively distinct, set of activities. This means that, even at the intrasite cluster level, artifacts in a cluster may be the result of a variety of adaptive sets.

Foraging Residential and Extractive Ethnographies

Results of cluster, block, noncluster, and isolated assemblages from Project 90-11 suggest that many occupations in the project area were residential. To determine the likelihood that residential sites are represented by a few features and a handful of artifacts, ethnographic examples referenced earlier were explored in more detail. These examples suggest that it is entirely possible the patterns discussed above are characteristic of a foraging residential pattern.

Yellen (1977) provides data on 16 residential camps used by !Kung bushman of southern Africa during the wet season, a period of high mobility. Using Yellen's data, a calculation of the average group size occupying these sites is 17 people, with an average stay of just over 9 days. The sites were residential locations from which groups ventured out to collect resources that were returned to the site, processed, and consumed, usually on a daily basis. The specific activities conducted at the camps varied as the nature of the materials brought back to the residential site varied. The activities geared to processing shifted as the type of resources collected changed. Resource fluctuation, in turn, was related to factors such as the location of the camp on the landscape, the time of the year, and the composition of the group. Of specific interest here is the artifact assemblage generated by these occupations. Although the groups in question had access to some metal tools, probably lessening the amount of lithic debris deposited, the overall artifact assemblage at a camp was surprisingly low. Even including wood tools and egg shells used for water storage, both of which are items not likely to remain for archaeological investigation, the average number of artifacts at a camp was 16.6. The median number was 7.5, and almost half the sites had 5 or fewer artifacts. Given that, on average, a residential camp was occupied for 160 person days, the deposition of fewer than 17 artifacts is surprising.

The most common materials other than artifacts at these sites were faunal and floral remains. These were scattered across the site, and again would be unlikely to survive for any length of time. Features, which may include a few brush shelters, scattered charcoal, and a few hearths, also would have low archaeological visibility (Yellen 1977: 78–83).

While Yellen's !Kung data is the most complete, there are additional examples of residential remains generated by short term, high mobility, groups. Nicholson and Cane (1991), working in Australia, recorded a series of camps produced by

aborigines primarily in the 1940s and 1950s. They visited these locations with the previous inhabitants in the 1980s, collected surface artifacts and noted feature locations. Four of the 15 camps were habitation sites where family groups carried out cooking and sleeping activities over several days. These sites were organizationally similar to the !Kung sites. While data on the length of stay and number of occupants is not complete, the group size seemed to be quite small, on the order of five or six people, and the maximum length of occupation appeared to be about two weeks. The four camps had a total artifact assemblage of 27, an average of less than seven artifacts generated per residential occupation. A total of 16 features, or four features per occupation, was present, and no houses were noted. These types of residential occupations, then, do not generate remains commonly associated with residential activities.

The final category of remains are those associated with extractive locations. Extractive locations—the types of activities that may be associated with much of the noncluster and nonsite material, and may also contribute to the clusters to an unknown degree—involve the procurement of low-bulk materials and result in little or no remains left on the landscape. Hayden (1978: 188–191) provides a description of the types of remains generated by one type of extractive activity, wood procurement, in western Australia:

> They are spatially segregated from the base camps and are occupied for short durations (usually only a matter of hours at the most) .... the tools used are often obtained locally near the procurement site, and are generally left at the site after the activity is accomplished ... if one walked extensively among the mulga grove, one could see an occasional chopping implement usually left at the base of a decaying mulga truck. Rarely were there more than two chopping implements.

Both extractive locations and foraging residential base camps are generated by highly mobile, short-term residential groups. They produce artifact and feature patterns well within the range seen in the Project 90-11 archaeological sample. This does not mean that the occupations were primarily generated by similar organizational activities, but the ethnographic patterns do not contradict the suggestion that many could be the product of a residential focus. The possibility that much of the occupation in the project area is the result of residential activities is further supported by limited resource distribution as a focus for logistical sites and patterns that fit the expectations for a residential occupation in artifact type and number at the site, cluster, and block levels.

Adaptive Role Changes

At least some data in the central basin suggests that foraging residential occupations were responsible for the generation of much of the Project 90-11 data, and some cluster and block level patterns may also reflect special purpose locations. Patterns in flake debitage, feature density, and artifact types seem to be consistent with these group characteristics. Finally, a significant portion of the artifacts may reflect extractive tasks. Ethnographic examples suggest that the patterns of remains discovered archaeologically are characteristic of these types of uses.

A decreasing frequency of radiocarbon dates after 1350 B.P. has been identified in the project area, as well as a later use of obsidian and projectile point typologies that hint at a later use of the area. These temporal divisions may be related to a shifting pattern of use in the central basin, which makes dating the various cluster and block groups of considerable importance. Data that suggest a change in the temporal pattern of the various groups may correspond to the changes in the chronometric break identified in the radiocarbon dates.

If the Group 1 clusters represent a special purpose or a logistical focus distinct from the remaining clusters, then dating these occupations is of considerable interest (Table 12.4). Five of the six clusters have multiple dates, with three of these spanning several thousand years. These three clusters may represent multiple occupations, or obsidian dates are not associated with the majority of items in the cluster. This pattern of multiple dates, in combination with the assemblage analysis, suggests that if the clusters were reoccupied, the nature of the reoccupation probably was the same through time. All six clusters had obsidian dates more recent than 1350 B.P., the period when feature dates began to decrease. When seen as a group, 14 of the 20 obsidian dates (70 percent) were after 1350 B.P. The percentage of

post-1350 B.P. obsidian dates is higher than the percentage for the entire sample of dates where just under 62 percent of all dates are after 1350 B.P. Group 1 cluster dates, then, while difficult to interpret, may be slightly later in time, suggesting that the frequency of some form of special purpose or logistical occupation may increase after 1350 B.P.

Table 12.4. Obsidian Dates on Clusters.

Site	Cluster	Dates (#)	Earliest	Median	Latest
FB6741 41EP1028)	22	3	1283	1074.5	866
	39	1	836	–	836
	49	2	2328	1444.0	560
FB7484 (41EP1034)	27	9	4474	2564.5	655
FB12229	9	3	4012	2545.0	1078
	29	2	1151	1055.0	959

Radiocarbon dates from the low variability block assemblages have a somewhat similar distribution. Two of the seven blocks with low variability lack dates and eight features in the remaining five blocks have dates. At the block level, two of these five have dates of 635 B.P. and 1066 B.P. The remaining three blocks date before 1350 B.P. Of the eight feature dates, five are earlier than 1350 B.P., while three, or 37.5 percent, are later than 1350 B.P. This 37.5 percent occurrence of post-1350 B.P. dates compares to only 21 percent of features on the project. Thus, as with the surface clusters, there is some evidence that these special purpose or logistical assemblages were, as a group, later in time. However, they did occur throughout the sequence at some level. Finally, obsidian dates for noncluster material have essentially the same distribution as the dates on clusters, with a peak between 800 and 900 B.P.

Radiocarbon and obsidian dates on features may be picking up different activities at the project level: activities centered around features, activities that produced radiocarbon dates, and activities not centered around features, but revealed by obsidian dates. Patterns revealed by these two dating techniques suggest that feature-based activities began to drop out around 1350 B.P., while nonfeature dates increased late in time. Given the frequent occurrence of features on the residential clusters, it may well be that these occupations primarily date prior to 1350 B.P.

Obsidian dating, which was the primary method for assigning surface clusters, supports this observation. Yet, the clusters often have multiple dates. It may be that extractive activities are frequently reflected by obsidian dates. While there is no difference between cluster obsidian dates and noncluster dates, clusters may well contain multiple dates.

These suggestions should not be interpreted as indicating that all features reflect residential use or that all obsidian dates reflect extractive activities. Clearly, extractive activities can be associated with features, as can special purpose and logistical sites, but in general, residential sites should contain features, while extractive locations should not.

Assuming that about 1350 B.P. an adaptive shift began in the way that the project area—and potentially the entire central basin—was used, and that this shift reflected a decreasing use of the central basin as a focus of residential activities, why did it happen? Several factors may be relevant, including changes in subsistence and changes in effective moisture.

If the period of major use of the basin as a focus for residential activities occurred between roughly 3500 and 1350 B.P., then it is interesting that this period has some relationship to the 1,500-year period between 3000 and 1500 B.P. that may have been a period of greater effective moisture. As the basin is a water-controlled environment, both the onset of use and the termination of use may be related to general climatic patterns. Consistent access to water is not currently present in the central basin. If this 1,500-year period had greater effective moisture—a proposition with some support—then it may have been possible to support small, widely scattered, highly mobile groups during portions of the year. These types of occupations, geared to the collection of wild plant and animal resources, may have been viable if effective moisture was increased. After 1500 B.P., if a more modern climatic regime was established, the lack of available water would have made this strategy increasingly difficult to maintain and should have eventually resulted in abandonment of the central basin for residential occupation, with a shift to areas where water was more consistently available.

Regional adaptive changes, such as increased dependence on agriculture and changes in mobility, should also be associated with the dramatic change beginning after 1350 B.P. The end of the Mesilla phase may be associated both with increasing agriculture and decreasing mobility. These trends continued into the subsequent Formative period. These regional subsistence changes may have influenced the degree

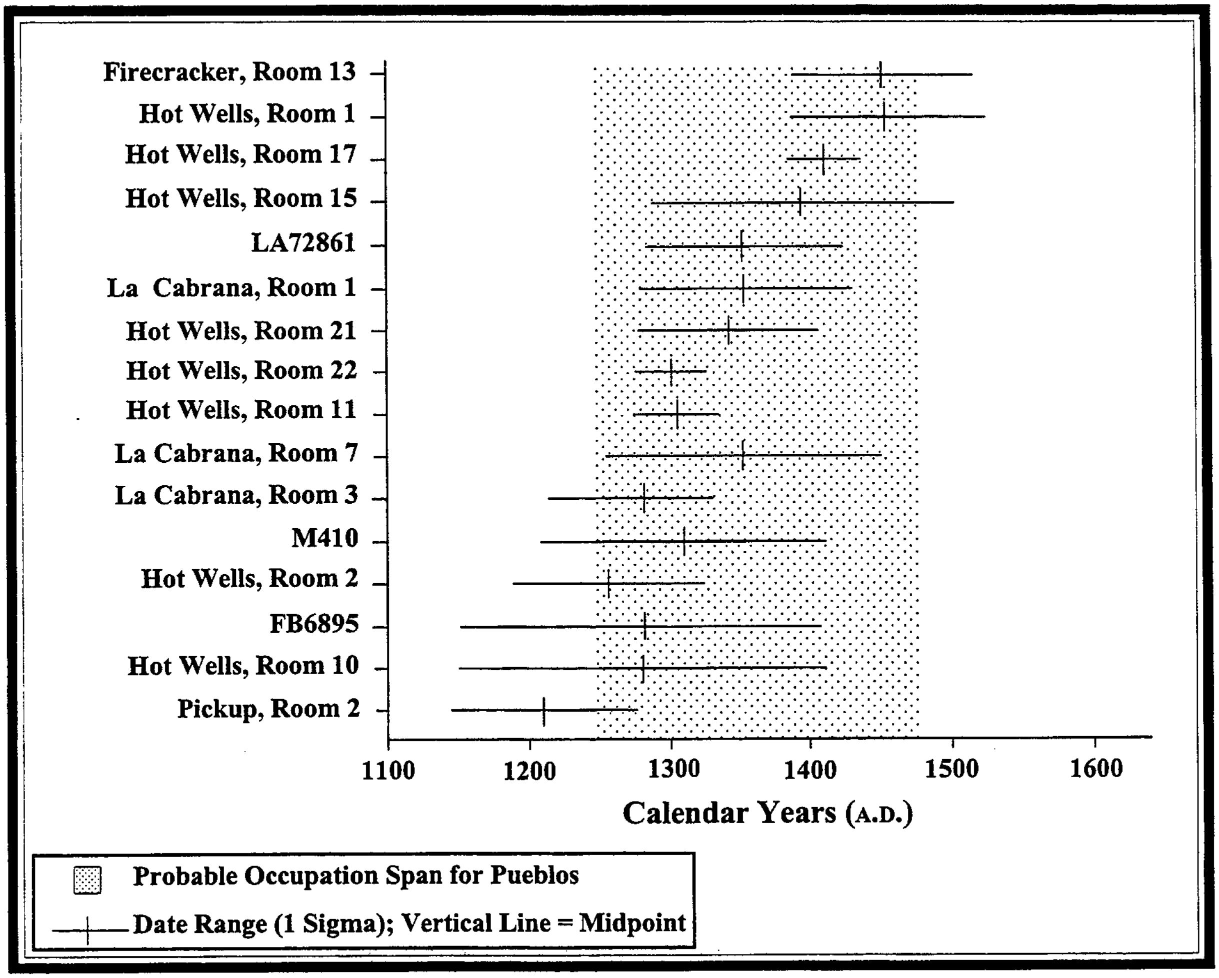

Figure 12.8. Pueblo Rooms ($N = 17$; 7 Sites) with Radiocarbon Dates.

and type of use represented by small sites in the central basin.

Data from this project suggests that the central basin sites represent a hunting and gathering component of an adaptation. That adaptation certainly involved agriculture, but the agricultural activities were not conducted at these sites. These sites appear to have been focused on plant gathering and hunting. Perhaps, then, the decrease in the frequency of these sites in the central basin may represent a decrease in the importance of hunting and gathering activities and an increasing emphasis on agriculture: people may have been present on the alluvial fans for a longer period of time. The alluvial fans were probably among the better areas for agriculture in the region as both soils moisture and water should have been more consistently available. They were exploiting the resources in the central basin from the fans, probably by daily foraging trips. With a foraging radius of 10 kilometers, a common distance cited in ethnographic accounts of hunter-gatherers, much of the basin is within a daily foraging radius.

If this is the case, some evidence for increasing agriculture can be expected just after 600 A.D. There is such evidence, both in settlement pattern shifts to more well-watered areas such as the lower alluvial fans and in suggestions of more permanent occupations with more substantial pithouses. Unfortunately, current data are not sufficient to address the issue of increasing agricultural dependence directly. However, the culmination of the trend can be considered by briefly examining late Formative period settlement patterns.

Figure 12.8 presents radiocarbon dates for pueblo rooms excavated in the El Paso area. This list is not exhaustive, but it probably contains most of the cases in the literature. Note that pueblo architecture

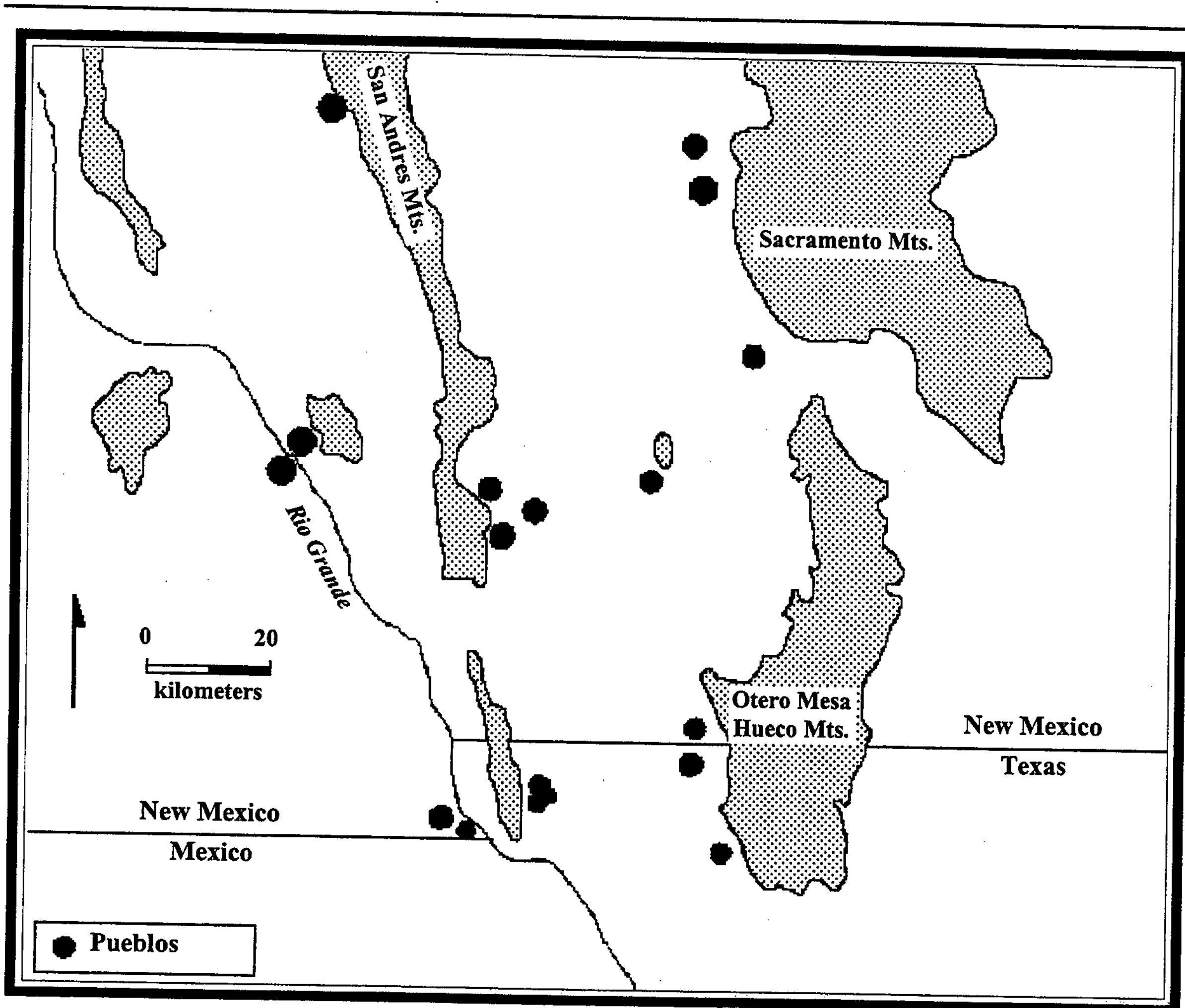

Figure 12.9. Known Pueblo Locations in the Central Jornada.

does not seem to be widely used in the area until after A.D. 1250 (700 B.P.), and possibly not until after A.D. 1280, which suggests several problems with assumptions traditionally made regarding the presence of polychrome ceramics and an El Paso phase adaptation.

Figure 12.9 illustrates the distribution of several excavated pueblo structures or areas with multiple sites that have pueblo architecture present. Again, there are probably several additional cases, but the figure contains most areas where pueblo structures have been excavated. The sites are clustered either near alluvial fan settings or near the river—areas that are well watered. While it is unclear that pueblo architecture necessarily implies a sedentary—or year-round occupation—it seems to be the case that this level of investment in architecture is associated with increasing levels of occupation. Pueblo settlement may be the culmination of trends that began around 1350 B.P. towards decreasing use of the basin for residential occupation and increasing use of the alluvial fan and river settings. This trend is suspected to have had to do with increasing importance of agriculture in the diet and a change in the way that wild plant and animal resources were procured.

This does not, however, suggest that sites on the alluvial fans represented year-round occupation, or that residential sites earlier than 1350 B.P. were limited to the central basin. There was probably still a substantial amount of seasonal residential mobility after 1350 B.P. However, the new mobility increasingly avoided the central desert area as a residential focus. Residential sites in the central basin are few and appear to be larger, consisting of multiple houses and associated trash such as the Turquoise Ridge site or the Huecosito site (Whalen 1994); they are no longer the small sites that lack any significant trash accumulation. The establishment of pueblos along

the river and alluvial fans follows the close of the Mesilla phase. The location of these pueblos may be the culmination of a pattern of decreasing mobility and, possibly, increasing agricultural reliance that began after 1350 B.P. and is reflected in the data from small sites in the central basin.

Summary

Previously developed typological schemes rely on some combination of site size, artifact variety, and feature numbers as distinguishing criteria (Anderson 1993) to consider changes in the adaptive role of locations. Using these approaches, however, guarantees almost no opportunity to explore patterns of variability in the data. Differences in sample size, a primary element in determining relationships between variables, are generally not considered, nor are patterns of changing land use, reoccupation, or factors such as changing survey intensity and patterns of erosion and deposition that may account for the occupations.

It is not analytically useful to pigeonhole the types of occupations dealt with here into predetermined categories. This approach assures that the complexities will be ignored. These small sites are not only ubiquitous and numerous, but they are extremely complex. The types of occupations appear to be common in the central basin, though they may have been frequent throughout the area but are masked by later deposits. Patterns in artifact variety at both the block excavation and the cluster level of analysis suggest differences in occupations that may provide information about different strategies of land use.

If the present interpretation of these differences is supported in subsequent work, the changing chronometric patterns on small sites may suggest that the central basin began to be abandoned for residential use over several hundred years starting around 1350 B.P. Obsidian dates suggest the area was used for collecting resources rather than a residential location. This change in mobility patterns may be related to an increase in agricultural and a decrease in effective moisture, but data to assess these suggestions are not available.

Finally, if the scale of clusters and blocks is at all appropriate, and if the patterns of adaptive change are anything like those suggested, the site level data, which previously combined a variety of temporal and probably functionally distinct activities, may also contain a variety of organizationally distinct forms. Any given site may contain the remains of several distinct adaptive, functional, and temporal elements. While sites are, then, an adequate management unit, they are not an appropriate analytical unit. In fact, even the cluster and block levels may be too large to investigate certain questions—and much too small to investigate others.

Chapter 13

MANAGING SMALL SITES

Small sites, the type of occupations dealt with in this report and by far the most frequent type of site on Fort Bliss, were not incorporated into the protection strategy outlined in the 1982 Historic Preservation Plan. Before Project 90-11 there was little information about temporal placement, functional range, or adaptive roles represented by these occupations. Two major goals of this project were to begin to develop a preliminary classification of functionally and temporally distinct types of small sites, and to design more cost-effective ways to deal with these occupations. These classes of small sites could then be protected and, when necessary, sampled or mitigated efficiently.

The site level may not be appropriate for most analytical questions on these types of occupations. The small sites identified on this project are, in many cases, amalgamations of different temporal, functional, and organizational activities. Given the lack of knowledge regarding small sites, the poor quality of the extant survey data, and the rate of military impact on Fort Bliss, a different protection strategy for all archaeological remains on post is suggested. Several steps will be necessary to accomplish a new protection strategy, including the development of new survey techniques. This suggested strategy is geared to landforms rather than sites because there is no recognizable difference on survey between large and small sites other than their size, and site size is determined as much by survey intensity and geomorphology as prehistoric behavior.

Analytical Units, Management Units, and Small Sites

Small sites are the most frequently recorded category of sites on Fort Bliss. In 1994 the Fort Bliss database contained 9,401 sites less than 0.25 hectares in size (Figure 13.1); the sites comprised 87 percent of the known sites on post. Results of the Project 90-11 survey suggest that the actual number of sites on Fort Bliss probably exceeds 100,000.

Sites may frequently be composed of a variety of occupations. These occupations not only may be temporally distinct, but probably have a variety of activities associated with each temporal unit—and these activities may reflect different adaptive roles. It appears, then, that the site level is not an appropriate analytical unit within which to investigate variability in temporal, functional, and adaptive differences. Sites defined by some absolute difference in artifact density do not necessarily translate into appropriate analysis units. This is not a problem of definition of what constitutes a site—any definition will have the same problems. One component of the problem centers on confusion between sites as management units, sites as analytical units, and the necessary units at which archaeological variability should be protected from military damage.

Site boundaries in the project area are the result of survey intensity and geomorphic processes. These boundaries, when coupled with arbitrary definitions of what constitutes a site, may, in some cases, group unrelated occupations or artifacts into a single unit (a site). In other cases the deposition of built-up sands resulting from erosion may divide related occupations into a series of sites. Questions about the function of a site are difficult to consider in these sorts of settings. The materials within the site boundaries may represent the remains of a variety of different uses, just as they may represent the remains of a variety of different temporal components and different adaptive strategies. For example, FB7483 (41EP1037) is 1.7 hectares in area and the only diagnostic artifacts on the surface were several small, side-notched arrowpoints that probably date to the El Paso phase. Based on these data, the site dates between A.D. 1150 and about 1425. Without further work on the site, the entire occupation can be assigned to the El Paso phase, and the 1.7 hectares become a statistic in discussing population levels, nature of occupation during the phase, and the role of the site in changing adaptive contexts.

Radiocarbon dates for FB7483 span almost 6,000 years, but no El Paso phase dates are present. The occupation clearly represents several temporal periods, probably several functional activities, and

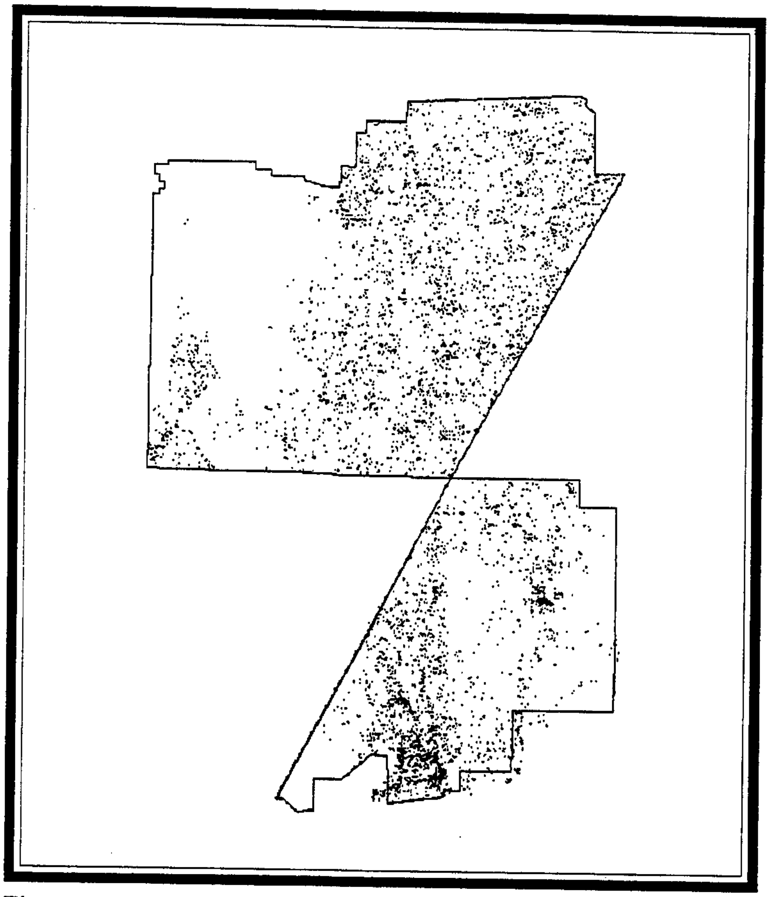

Figure 13.1. Sites Less Than 0.25 hectares in Size in Fort Bliss Maneuver Areas (1994).

possibly several adaptive roles. The El Paso phase points, then, may be only a small component of the overall adaptation represented at the site. The site probably results from a variety of residential occupations as well as a few special purpose occupations, and probably contains the remains of extractive activities.

This is not an uncommon occurrence. Sites in the current project area are composed of a series of different occupations, each of which may have relevance to different analytical concerns. This is why analysis of Project 90-11 data included an attempt to reduce the scale of investigation to intrasite clusters and block excavations. Yet, even this smaller level is, in some cases, too large because any given cluster may contain a variety of unrelated remains. The obsidian and radiocarbon dates on cluster and block level data demonstrated many significant overlaps, with a given cluster spanning several hundred, or even several thousand years.

Differences between features of different temporal periods cannot be distinguished consistently. A late Archaic stain with four flakes looks astoundingly similar to an early Formative period stain with four flakes. Making the questionable assumption that material within a given cluster or block represents a single temporal or functional assemblage, there is little, if any, difference between late Archaic and early Formative period assemblages. It is unlikely that any significant number of small sites can be placed into a temporal period based on survey data in the near future.

Increasingly smaller scales, below that of the cluster defined in this report, could be used in an attempt to dismantle small sites. In several cases, excavation data revealed artifact distributions that seemed to be associated with specific features. Figure 13.2 (top) shows an excavation block on FB6741 (41EP1028). Note the relatively clean spatial separation between the artifact clusters, and the spatial

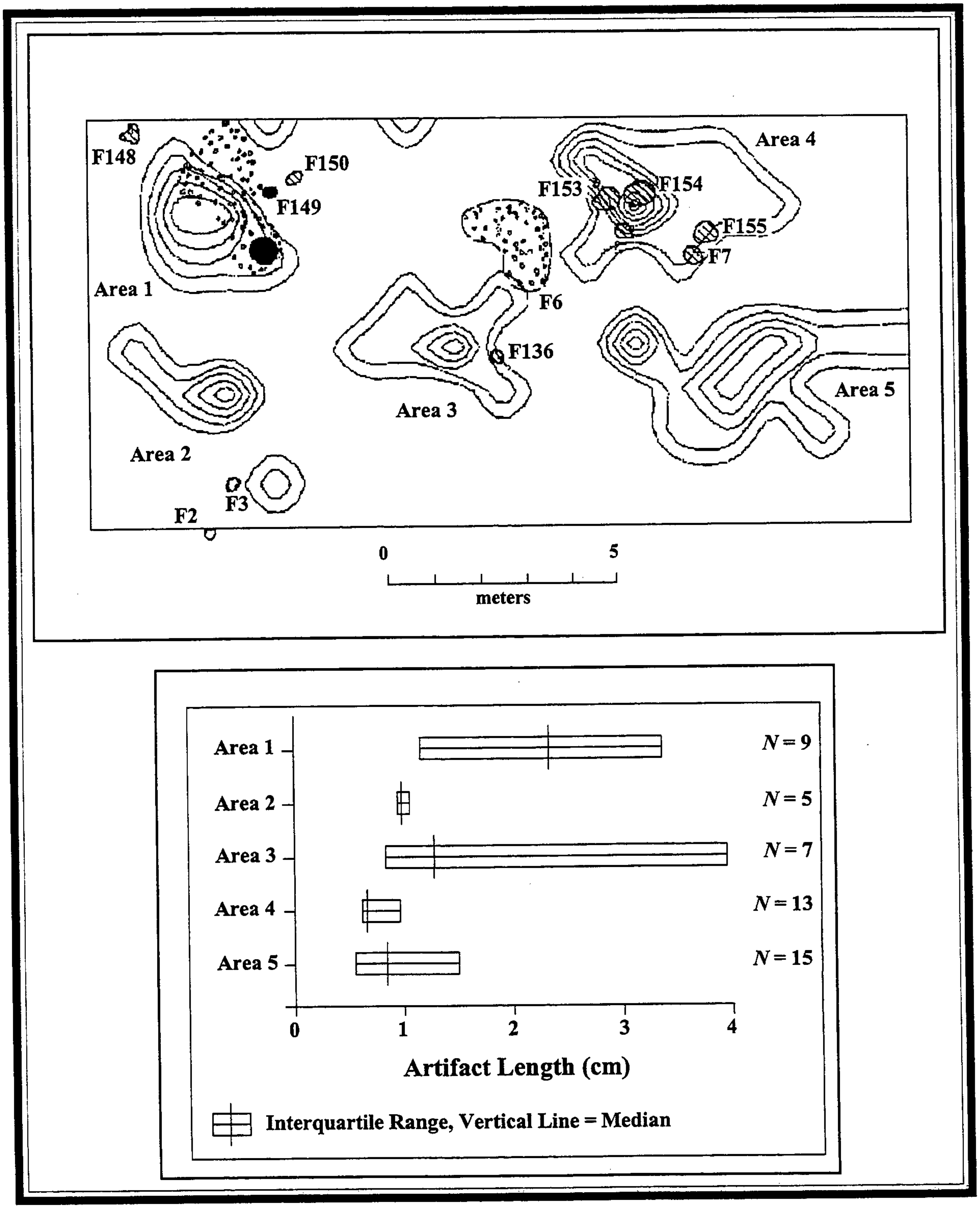

Figure 13.2. FB6741 (41EP1028). *Top,* Artifact Density Contours and Feature Associations; *Bottom,* Interquartile Range of Artifact Lengths in Site Areas.

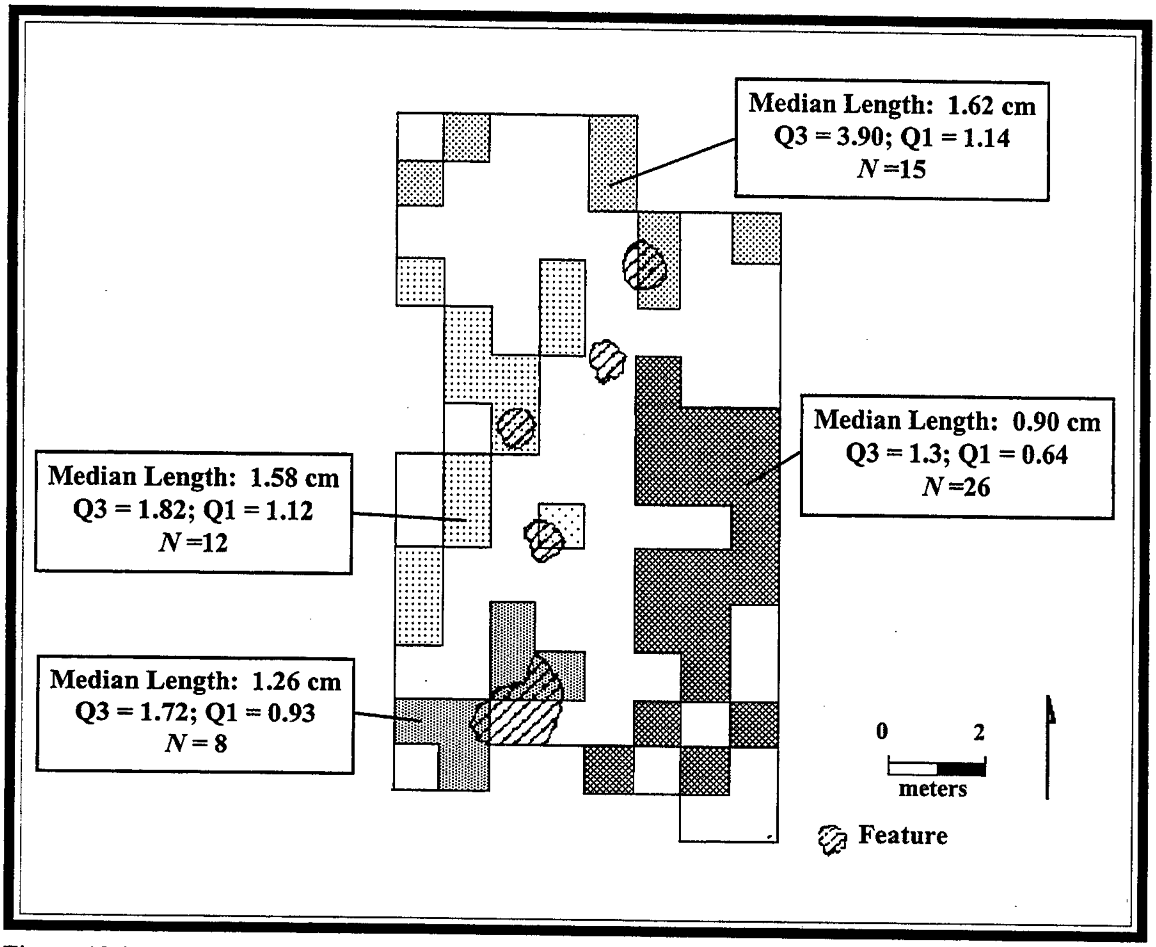

Figure 13.3. Artifact and Feature Distribution in Block 7, FB7483 (41EP1037). Different groups of artifacts are based on contour designations.

association of the clusters with feature clusters; radiocarbon dates are available from the northeastern cluster (Area 4). The bar graph (Figure 13.2, bottom) compares the flake length from each of the five cluster areas. None of the sample sizes for the intraexcavation areas exceed 15 artifacts, which renders any absolute statement regarding their statistical separation impossible, but several interquartile ranges and median values are dramatically different. These differences in flake length do not necessarily imply different functional, adaptive, or temporal components within the block; however, grouping all the material together into a single "assemblage" that dates to a given time period should be approached with hesitation.

Figure 13.3 demonstrates another type of feature-to-artifact relationship. Dates on four of the five features are statistically identical and place the occupation in the early Formative period. Yet, there are dramatic differences between chipped stone assemblages that are spatially distinct. These distributions may reflect different activities associated with different hearths, different occupations that are not discernible with radiocarbon dates, or patterns associated with activities such as maintenance of work space around hearths. It is even possible the artifacts and the hearth are not related.

At present, there simply are not enough such cases to allow recognition and isolation of patterns that may provide clues for subsequent work. It may be possible, with a large number of such cases, to recognize patterns in associations and distributions. This should reveal patterns that do not fit and provide opportunities to explore conditions that result in these distributions. This may be, then, one analytical level that can be identified for sites. The critical point, however, is that the site level is analytically inappropriate.

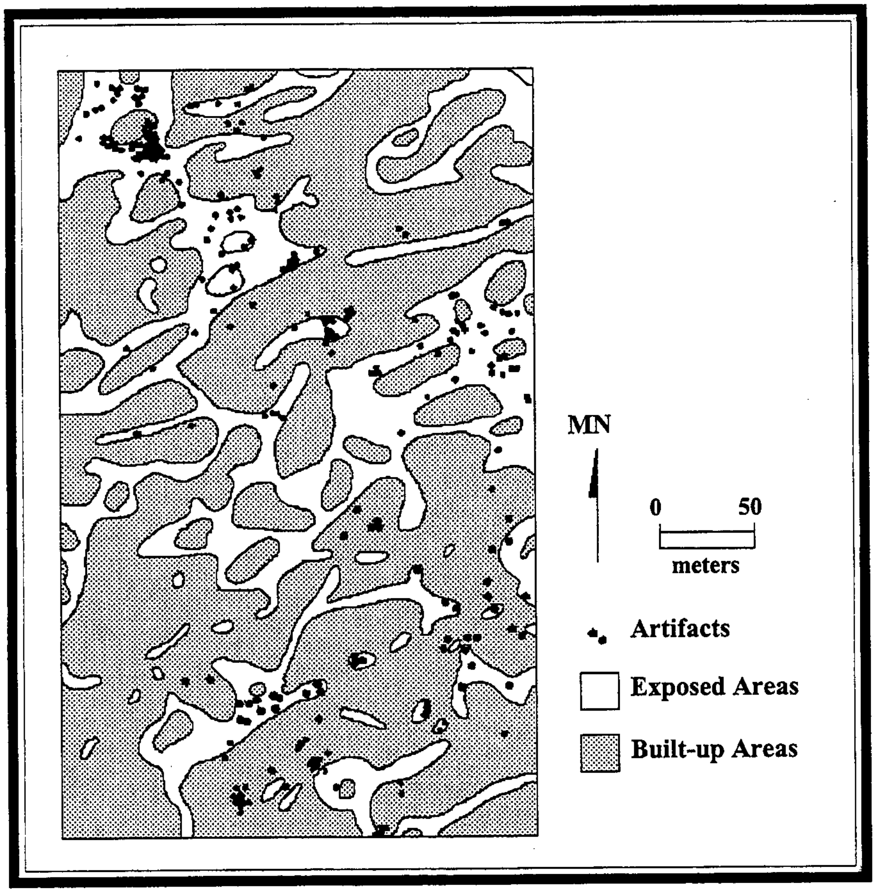

Figure 13.4. Artifact Distribution Relative to Exposed and Built-up Surfaces within a 10-Hectare Block.

A final example of the problem of developing appropriate scales and the inadequacy of the site level for analysis is seen in a 10-hectare block in the southern survey area along the playa ridge. Figure 13.4 shows artifact distribution and levels of exposure in a block cut through portions of four sites, including all of FB12017, significant portions of FB7484 (41EP1034) and FB12102 (41EP4908), and the western half of FB7483 (41EP1037). A transit and tape were used to record most of the artifacts at a site level, so connecting sites over distances greater than several hundred meters became increasingly chancy. The datum points on the four sites, however, were reasonably close together, and it was possible to tie the artifact locations together with some degree of confidence. The 10-hectare area also had some level of excavation, providing subsurface material for comparison.

Most exposed areas and built-up areas in the block run west-southwest to east-northeast, the direction of the prevailing winds during the spring when gusts are high and soil moisture is low, and artifacts occurred more often in exposed areas than in built-up areas. Thirty-two percent of the 100,000 square meters in the block were classified as exposed, and 67 percent of the 349 surface artifacts were recovered in exposed areas. Artifact density in exposed area (0.0073 artifacts per meter) was over four times as great as in built-up areas (0.0017 artifacts per meter). The most likely explanation for this pattern of concentration is that as winds scour out blowouts, the sand is deposited into sand ridges and mesquite dunes. The blowouts contain artifacts winnowed out of the sand and concentrated onto the exposed surfaces. Conversely, the sand transported into the dunes and into ridges associated with dunes covers up most artifacts. The blowouts, then, are windows into the underlying distribution of artifacts and features.

The effects of exposure were further explored by comparing the expected and observed percentages

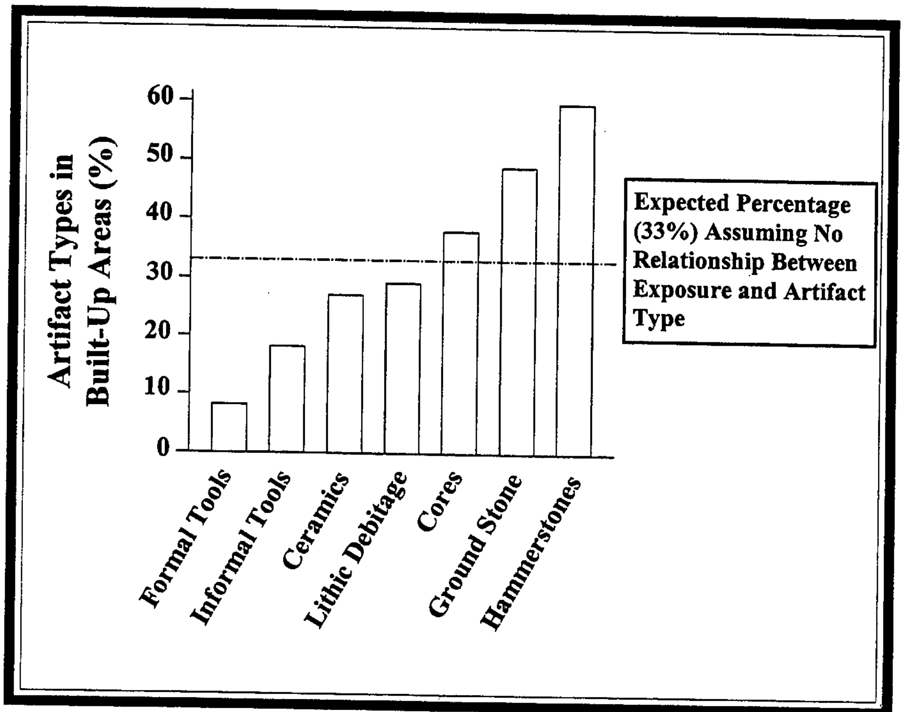

Figure 13.5. Artifact Types Observed in Built-up Surface Areas within the 10-Hectare Block (Figure 13.4) and Expected Percentages. No relationship is assumed between exposure and artifact type for expected percentages.

of various artifact types (ceramics, cores, debitage, etc.) found in the built-up areas on the surface of the 10-hectare block (Figure 13.5). The expected percentage (33 percent) assumes no relationship between differential exposure and the recovery of specific types of artifacts. However, this was not the case. Hammerstones, ground stone, and cores are all overrepresented in the built-up areas, while lithic debitage, ceramics, and lithic tools are less common than expected. Interestingly, the more common artifact types tended to be large.

Lithic artifacts from built-up surfaces ($N = 108$) had a mean size of just less than 4.0 centimeters with a median size of just more than 3.0 centimeters (Figure 13.6, top). Those recovered from the exposed surfaces within the 10 hectare block ($N = 211$) had a mean size of just less than 3.0 centimeters and a median size of about 2.5 centimeters. Finally, lithic artifacts from excavation and testing ($N = 371$) had a mean size of less than 2.0 centimeters and a median size of less than 1.5. The setting clearly had a significant impact on the size of the artifact.

This dramatic size sorting, in turn, led to differences in other characteristics (Figure 13.6, bottom). The percentage of flakes within each of three cortex coverage categories in the 10-hectare block suggests that the subsurface assemblage represents activities involving tool production or retouch. Over 55 percent of the nearly 300 lithic artifacts lacked any cortex and were quite small. The pattern from the surface debitage collected in exposed areas suggests earlier reduction; 41 percent of the assemblage lacked cortex and the assemblage was of moderate length. Finally, early reduction can be suggested for the debitage from the built-up surfaces within the block. The percentage of debitage without cortex was less than 30 percent, and those flakes with more than 50 percent cortex made up almost one-third of the assemblage. The assemblage was also dominated by larger flakes, cores, and hammerstones. These patterns are directly related to the sizes of artifacts in the assemblage, which in turn are the result of geomorphic size sorting rather than prehistoric behavior.

These patterns have widespread implications. At low survey intensity, this 10-hectare area would be recorded as a series of small sites dominated by debitage suggestive of tool production. At high survey intensity, the distribution would be quite different, probably composed of a few larger sites representing a wider variety of activities. Survey of the

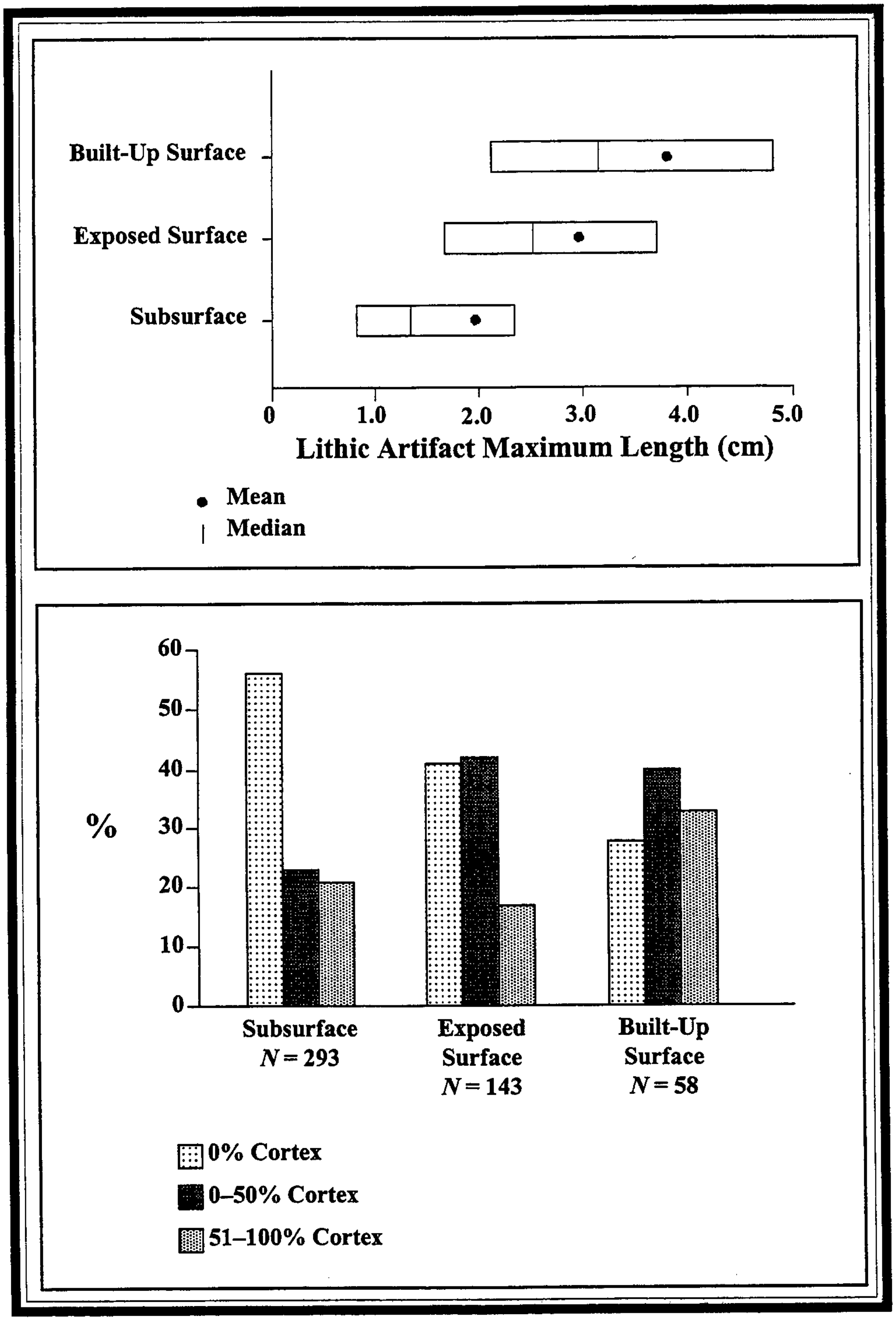

Figure 13.6. Artifact Characteristic Differences. *Top,* interquartile range, median, and mean of all lithics within the 10-hectare block (Figure 13.4); *Bottom,* cortex on debitage within the 10-hectare block.

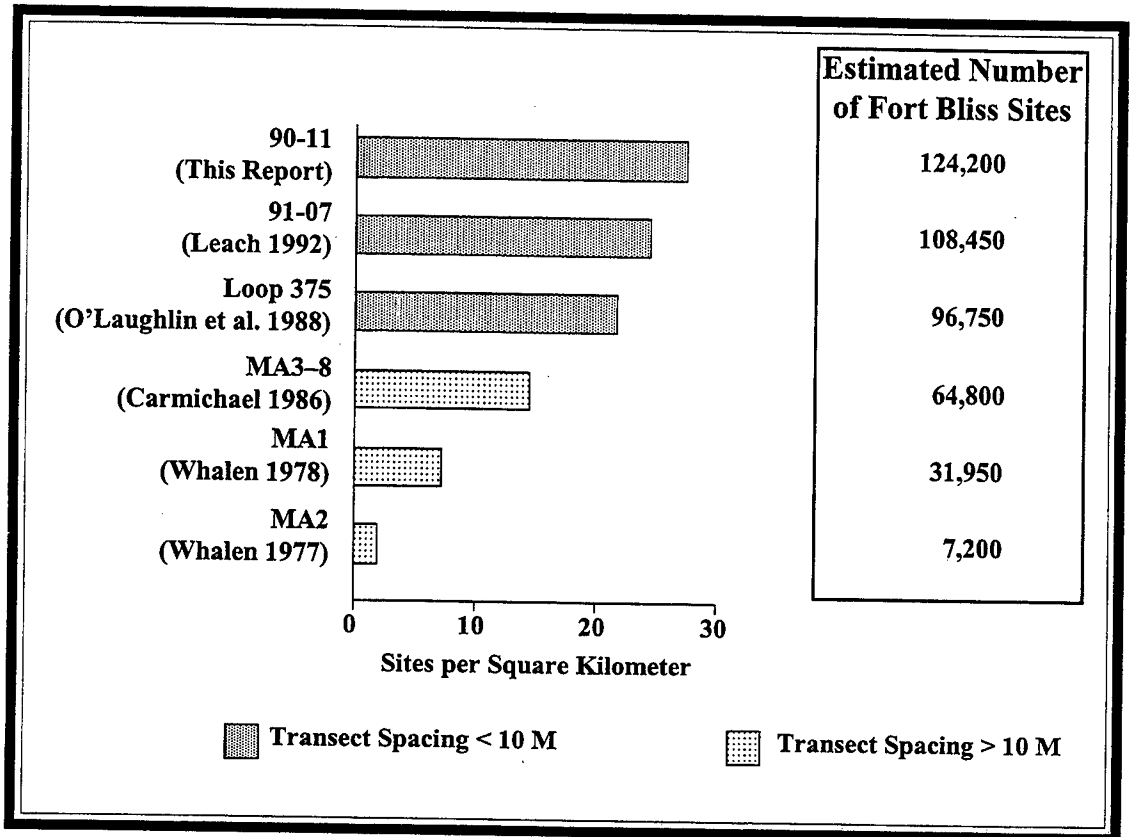

Figure 13.7. Estimated Number of Fort Bliss Sites Based on Site Densities Recorded by Various Surveys. MA3–8 totals include some scatters that are now defined as sites.

same area after a few years of strong spring winds probably would reveal quite different site distributions, and excavation would reveal other patterns. The critical point is that this is an active environment. The recorded patterns are as much a result of survey intensity and the particular geomorphic history of the area as they are of prehistoric behavior. The site level, as currently used on small sites, is not appropriate.

Yet, paradoxically, the site level is a critical component of the Fort Bliss management strategy outlined in the 1982 Historic Management Plan, as well as much archaeological research. Ebert (1992) summarizes a variety of studies that discuss the inappropriateness of sites for many types of analyses, but the concept is widely used in the field as the primary analytical unit. It is entirely possible to abandon the site as an analytical category, but maintain it as a management unit. Sites, however defined, contain a variety of temporal, functional, and adaptive elements. While this is clearly apparent in the Project 90-11 data set, most sites on Fort Bliss probably have similar patterns. It is critical that the question of whether a site contains data that are significant to a set of research contexts is distinct from ways to identify that data and investigate those research issues. For example, if features with stains and certain sets of artifacts are a significant class of material for determining temporal, functional, and adaptive considerations, can the question be asked whether a given management unit, that is, a site, has that class of features with artifacts present. That is, the analytical concerns are, in this example, at a feature-by-feature basis, but the management units are, necessarily, are on a site-by-site basis.

Unfortunately, those arguments cannot be made, in part, because of a lack of adequate survey data. Early Fort Bliss surveys, while completely appropriate for the time, did not provide detailed information. Figure 13.7 presents a comparison of the number of sites per square kilometer recorded for six surveys, along with the estimated total number of sites suggested by these various densities for the military reservation. Surveys of Maneuver Areas 1

and 2 done in the 1970s (Whalen 1977, 1978) employed transect spacing at about 46 meters between crew members. The Maneuver Area 3–8 survey done in the 1980s (Carmichael 1986) used a 33-meter transect spacing. The Loop 375, Project 90-11, and Project 91-07 surveys in the 1990s used transect spacing below 16 meters in width. The dramatic increase in both the site density and the estimated number of sites on Fort Bliss is clearly related to increased survey intensity.

Any cost-effective management strategy with a database as vast as that at Fort Bliss cannot rely on mitigation through excavation as a primary management strategy. Even with a complete understanding of what data are significant and the distribution of that data across time and space, to mitigate a representative sample of these areas at only 10 percent would require work on 10,000 sites. Such a task, if it could be accomplished, would require millions of dollars and much time. If one site was mitigated every two days, 365 days a year, the job would be completed in just over 50 years. This figure does not include laboratory work, analysis, write up, or publication.

Even if this could be accomplished, we do not have 50 years because the military impact is ongoing. By its very nature, training will probably damage nonrenewable cultural resources. Cultural resources on the reservation, unlike endangered plants or animals, are not likely to make a comeback if the threat is lessened. The principal mitigation strategy, then, has to rely heavily on protection in the short term rather than a reduction in training in some areas. Time is needed to document the resources, to improve the understanding of the variability throughout the sequence and across the reservation, and to understand what types of data are significant in the context of evolving research questions.

A given site may contain examples of significant temporal, functional, and adaptive data. The question of significance at a site level can still be asked, and answered—but that answer has to be formulated about arguments generated both at smaller and larger scales than the site. Not all areas within a site may contain significant data, and not all significant data may be in sites. A significant portion of the record is not present in sites, but is manifested as isolated artifacts on the landscape. Some of these probably represent different adaptive and functional contexts that are reflected in occupations grouped at the site level. If these are a significant component of the resource base, then it is important to have some strategy to deal with this class of remains as well. Given the ignorance about appropriate spatial scale, as well as the lack of adequate survey data, the unit of protection for these small sites—and probably all sites on post—should not be the site.

Fort Bliss Sites

Up to this point, investigation of these problems has centered on small sites, but it is probable that at least some of the same processes operating on small sites—specifically geomorphic patterns of erosion and deposition—affect other sites as well. These processes condition site boundaries, and therefore size, which results in different numbers and varieties of features and artifacts being included within sites. Much of the protection and management strategies of the 1982 Historic Management Plan was tied to protecting representative samples of temporal and functional classes of sites. These processes, if they affected all sites, had widespread implications for the overall cultural resources management strategy on Fort Bliss because these temporal and functional classes were created by reference to the number and kinds of artifacts present at a site.

Most records in the Fort Bliss site file are related to Maneuver Area 3–8 survey (Carmichael 1986). Other surveys, many of which were conducted before any attempt was made to systematize and standardize the results, also are incorporated into this database. A variety of information is recorded for each site, including observations on site size (recorded in hectares), the types of observed artifact types, the temporal components on the site, levels of erosion, and the dominant vegetation. Site size in hectares is recorded for each site.

Levels of erosion are recorded, although 87 percent of site records lack any code in this field. Five relevant erosional classes are: minimal (1 to 25 percent of the site damaged by erosion), low (26 to 50 percent), moderate (51 to 75 percent), high (76 to 100 percent), and severe (100 percent). For Project 90-11 comparative purposes, standard Fort Bliss size recording procedures were converted as follows: sites within the 0.01-hectare (100 square meters) category were converted to 50 square meters.

Table 13.1. Relationships Between Erosion, Temporal Assignment, and Median Site Size.

Erosional Assessment	Median Site Area (sq. m)	No Temporal Assignment #	No Temporal Assignment %	Temporal Assignment #	Temporal Assignment %	Total #	Total %
Minimal	3,250	97	38.80	153	61.20	250	100.00
Low	2,000	264	51.87	245	48.13	509	100.00
Moderate	1,600	169	53.99	144	46.01	313	100.00
High	2,500	118	42.45	160	57.55	278	100.00
Severe	500	15	88.24	2	11.76	17	100.00
Total		663		704		1,367	

Although several sites exceed this size, this upper end figure was used as an estimate of their area.

Table 13.1 contrasts the erosional fields with the presence or absence of a temporal assignment. As erosion levels increase from minimal to severe, the relative frequency of sites that lack temporally diagnostic artifacts increases fairly consistently from 39 percent of the minimally eroded sites to 88 percent of the severely eroded sites. The single exception is in the high erosion level. Similarly, as the level of erosion increases, the median site size decreases. On minimally eroded sites, the median site size is 3,250 square meters, while on severely eroded sites, the median site size is only 500 square meters. Again, the single exception to the trend is in the high erosion category.

Thus, while the data are of questionable quality and represent only a small number of the overall sites in the Fort Bliss site file, there does appear to be some relationship between erosion and both site area and the presence or absence of temporal assignment. As erosion increases, median site size decreases. As median site size decreases a higher percentage of sites lack temporal assignment.

Because only 13 percent of Fort Bliss sites have an erosional assessment, vegetation, a category that is much more frequently recorded for sites, was examined using the hypothesis that erosion is likely to be more substantial in areas dominated by mesquite than in areas where other vegetation is the dominant plant. Mesquite frequently occurs in coppice sand dunes, which suggests that areas where it is the dominant plant probably have been subjected to greater levels of erosion than areas characterized by grass, creosote, or other non-dune plants.

Of the 10,800 sites with vegetation information in the Fort Bliss database, those with mesquite are generally substantially smaller than sites with other modern vegetation (Figure 13.8). While this pattern of smaller sites in areas dominated by mesquite fits with the Project 90-11 results, it is possible that as mesquite dominates the central basin the pattern is spurious and results from the differential use of the basin. These size differences, however, are not exclusive to the central basin. In both the central desert and the alluvial fans and mountains, there appears to be a relationship between the presence of mesquite and smaller site areas (Figure 13.9). Outside the central basin, sites with mesquite as the dominant vegetation have a median site area of 400 square meters, while those without mesquite as a dominant plant have a median site area of 1,000 square meters. In the central basin, a similar relationship is present. Although the overall site size for both mesquite and non-mesquite area sites is smaller on the alluvial fans, the relationship between site size and vegetation is still present in the central basin.

Mesquite-dominated areas have smaller sites because the level of erosion is more severe than in areas dominated by grass, creosote, or other plants. As a soil erodes, sediments are deposited into dunes and form areas of built-up sands, which frequently link dunes. Thus, in eroded settings, while some areas are exposed, others are covered by deposition. During survey, these covered areas—if they obscured the ground surface between blowouts—may be interpreted as areas lacking artifacts. This may be especially problematic at low survey intensity where coverage between transects is minimal. Artifacts in built-up areas might be grouped together to form sites; in eroded areas, this distribution might be broken up into several smaller sites as the areas are divided by sand dunes and sand ridges.

If this suggestion has any validity, it has widespread implications for both the interpretation of

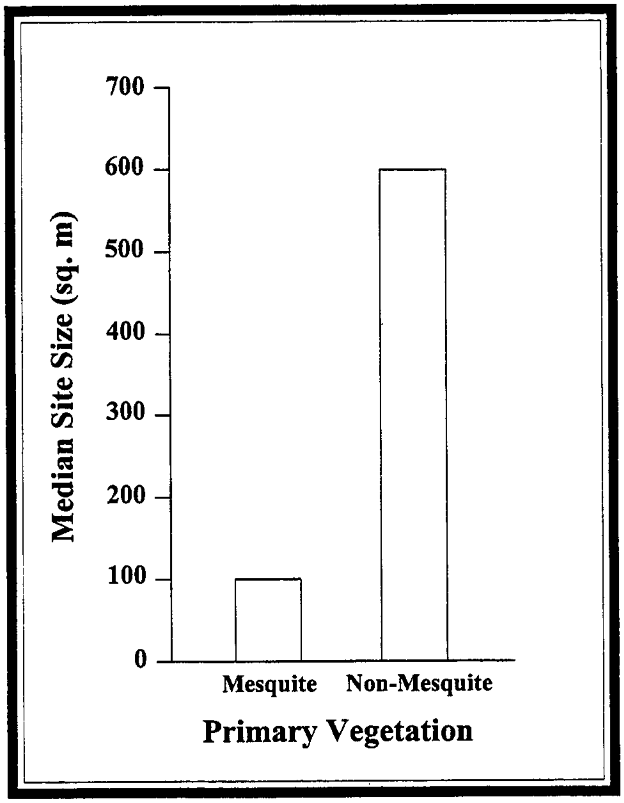

Figure 13.8. Median Site Size in Primarily Mesquite and Nonmesquite Areas.

site level data and management of the archaeological record. For example, the vast majority of the sites on survey are placed into temporal phases by the presence of diagnostic artifacts. These artifacts make up an extremely small percentage of the overall assemblage. If an assemblage is broken into smaller units, as probably is happening in the mesquite-dominated areas, the probability that any given area will have a diagnostic artifact decreases. Conversely, larger sites may have a higher probability of having some diagnostic present, due, in part, to the inclusion of more artifacts within larger boundaries.

Survey data from Fort Bliss was examined to determine relationships between site size and the number of components on a site (Table 13.2). The overall pattern seems strong. Sites that lacked diagnostic artifacts tended to be small; those with one temporal component, that is, with diagnostic artifacts that fall into a single period, increased in size, and those with diagnostic artifacts that represented more than one temporal component were substantially larger. As with the vegetation data, it could be argued that large sites were caused by reoccupation. However, if site boundaries were related to erosion and deposition and compounded by varying survey intensity, then another explanation suggests itself. Larger site boundaries result in more artifacts being included within a site and increase the probability that temporally different diagnostic artifacts will be found.

Table 13.2. Temporal Components and Site Area.

Temporal Components	# of Sites	Mean Area (sq. m)	Lower Quartile	Median	Upper Quartile
0	9,072	1,657.8	50	50	500
1	1,443	12,736.2	600	2,000	6,400
2+	309	48,789.2	3,300	10,500	31,300

Where mesquite was the dominant vegetation, more sites than expected (8,206 observed versus 8,048 expected) lacked any component designation (Table 13.3). Sites with one component (233 observed versus 163 expected) tended to be in areas without mesquite. This trend is exacerbated in cases with more than one temporal component (123 observed versus 35 expected). Again, the pattern is

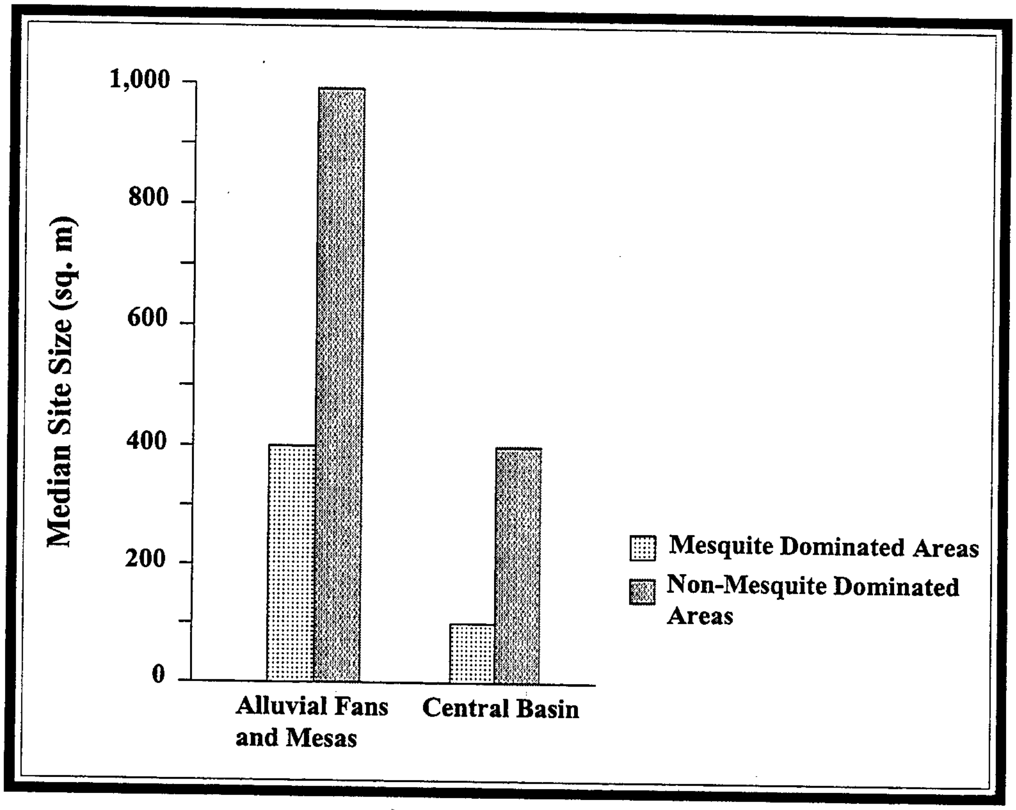

Figure 13.9. Median Site Size by Landform and Major Vegetation.

Table 13.3. Components by Vegetation Area.

Number of	Mesquite		Other Vegetation		Total	
Components	Actual	Expected	Actual	Expected	Actual	Expected
0	8,206	8,048	866	1,024	9,072	9,072
1	1,210	1,280	233	163	1,443	1,443
+1	186	274	123	35	309	309
Total	9,602	9,602	1,222	1,222	10,824	10,824
Percentage	88.70		11.30		100.0	

Table 13.4. Site Area By Number of Artifact Types.

Artifact Types (#)	Sites (#)	Mean Area (sq. m)	Lower Quartile	Median	Upper Quartile
0	3,535	147.90	50	50	50
1	2,080	600.00	50	200	400
2	1,712	1,944.40	50	400	800
3	1,270	2,828.40	100	600	1,500
4	756	5,274.30	200	900	2,500
5	497	6,737.70	500	1,600	5,000
6	331	19,536.10	800	3,000	7,900
7	248	18,579.80	1,850	4,600	11,950
8	181	41,239.50	2,400	7,000	18,000
9	93	48,330.70	5,600	11,900	37,700
10	61	69,653.30	6,400	18,600	69,300
11	40	96,492.50	11,900	38,950	97,150
12	13	94,307.70	20,200	53,300	127,800

Possible artifact types: cores and bipolar cores; debitage and flakes; informal tools; formal tools; Mimbres, Chupadero, Chihuahuan ceramics; El Paso Bichrome and El Paso Polychrome; undifferentiated brownware; El Paso Brown; mano; metate; other ground stone.

consistent with a relationship between vegetation (erosion) and site size. Erosion affects the visibility of the underlying distribution of artifacts and features, thereby revealing what appear to be small sites. Thus, the temporal assignments were, in part, a function of site size, and site size was related to the degree of erosion.

There is also a strong relationship between artifact variety and site size (Table 13.4). In fact, with the single exception of the reversed mean site size for assemblages with 11 and 12 artifact types, the rank order is perfect. Using median site size rather than the mean, the rank order is perfect.

Although several arguments can be presented to account for each of these patterns, erosion is certainly an important element. As the distribution of items is broken into smaller sites based on visibility, a decreasing number of items are present in any given site boundary. Thus, an artifact distribution in an eroded setting may yield 10 small sites, only one of which has a diagnostic artifact. The sites in this case would generally be small, and lack variability in artifacts. The same distribution in a built-up setting may be a single site assigned to a single temporal period and recorded as having a high number of artifact types.

This possibility, combined with the effects of survey intensity and the observation that the surface assemblage is a skewed sample of the artifact types, makes what seems to be a relatively simple problem of identifying sites, placing them into temporal groups, and assigning functional classes, incredibly complex. The complexity is further jumbled by arguments that any given landform may have a long history of use that is probably the outgrowth of different adaptive strategies.

These problems may be unique to small sites, but the data certainly suggest that the problems are inherent in the use of the site concept across the post. Even if the documented patterns affect only small sites, which is unlikely, these types of occupations make up roughly 90 percent of all sites recorded on Fort Bliss. Thus, the problem is widespread.

It is unlikely that small sites can be placed into any temporal or functional class based on survey data in the future. Just as important, given the arbitrary nature of site definition, it is also unlikely that the materials presently assigned to temporal and functional classes are really representative of the extant variability. The most effective use of resources is not in continuing to protect sites in districts representative of temporal and functional variability and continuing research designed to increase understanding of variability at a site level when there is substantial evidence that site level data may have little analytical reality.

Comments on Management Strategy

A critical component of the 1982 Historic Management Plan was periodic evaluation of the sample of sites protected in districts as understanding of chronological and functional variability increased. The results of archaeological research during the 1980s, both on and off Fort Bliss, suggest the time for reevaluation is now. Further, this reevaluation should consider a different protection strategy not focused on representative samples of temporal and functional variability at a site level.

Effective management solutions involving databases as substantial as that of Fort Bliss must rely on protection rather than excavation as the primary strategy: what will be protected and how will that strategy mesh with the training requirements? Ideally, management units should be at the same spatial scale as analytical units, but this is not possible. For some questions the analytical unit may be at the individual feature or structure level, while for others, the questions may involve the entire central basin. Few, if any, analytical questions will involve the site as such. Yet, the site has been the management unit.

Given the current understanding of sites, any effective strategy should involve five components. First, a complete survey database should be assembled; the current data are simply inadequate. This is especially the case in Maneuver Areas 1 and 2. Besides the possibility that there may be 10 times as many sites as presently recorded, for most the level of recorded data is the site. If a site has El Paso Polychrome anywhere within its boundaries, it is assigned to the El Paso phase. Similarly, a single El Paso Brown rim sherd yields a Mesilla phase designation, and the entire site is treated as a representative of the Mesilla phase, and included or excluded from protection based on that temporal categorization.

For example, scatter a few El Paso Polychrome sherds on FB7580 (41EP1753), a site with 26 surface features, ground stone, and lithics covering 2.3 hectares, and the site becomes an example of an El Paso phase scatter with a high variety of artifact types. Place this site in a sampling stratum, and it may be protected as a member of that population. At the other extreme, increase the level of erosion or decrease the level of survey intensity on FB6741 (41EP1028), an 8.2-hectare site with several ceramics concentrations (see Figure 5.2), and the result could be a variety of small sites divided by built-up sands. Each "small site" within FB6741 could contain different levels of temporal data, and each could have low artifact variability.

Clearly, better survey data is needed to understand what a site represents. This level of data will require a substantial revision in the methods used on survey, as well as the level of information collected. The goal of survey will not be simply to find out where sites are, but also to provide enough data on the intrasite distribution of artifacts and features to assess temporal and spatial patterns. It probably will also be costly. However, if this level of data can be acquired, it should greatly reduce the overall costs of dealing with sites in the long run by providing data that can be effectively used in sampling and protection.

Survey methods required to accomplish this task are currently unknown, but potential ways to learn what may be required include recording the same area with a variety of survey techniques. For example, select a series of 1-square-kilometer blocks in various environmental zones, record, but not collect, all artifacts and feature level information within those quads, and then conduct a series of surveys, each designed to gather information in different ways on artifact, feature, and isolated artifact information. This would build and refine the survey methods, and provide data on the overall time required to complete a given grid quad. What, exactly, these methods will be, is unknown at present. But, we feel confident that the problem can be solved, and that ultimately the quality of data should result in a much more cost-effective program.

Once these survey procedures have been obtained, it may prove possible to calibrate existing survey data with a sample resurvey tied to geomorphic and topographic zones. This should be possible in Maneuver Areas 3–8, and may work in Maneuver Areas 1 and 2. However, as the latter was surveyed at 46-meter transect spacing, a higher percentage of sample areas for resurvey may be required.

When these survey problems are solved and intrasite data can be collected efficiently, the second component of a management strategy becomes protection of a sample of both the intrasite components and the off-site components that will preserve the variability in the record. This component of the proposed management strategy will probably have to

be tied to major topographic and geomorphic divisions within the post. Strata, such as playa ridges and adjacent areas; the lower alluvial fans of the Franklin, Organ, and Hueco Mountains; and areas within the central basin not associated with playa ridges could be identified. Geomorphic units, such as those mapped by Monger (1993) should also be incorporated. It should then be possible to place a sample of each landform containing archaeological data into off-limits areas.

Protected areas would necessarily be scattered throughout the post, possibly in a series of spatial units, perhaps 1-by-0.5 or 1-by-1 kilometer squares that could be easily identified on training maps. They could be located to minimize interference with military training, and their relatively small size would make them easy to avoid or maneuver around. They would, on occasion, cut through areas presently designated as sites. They may, on occasion, protect areas that have few sites but many isolated artifacts. A strategy along these lines should preclude military or archaeological work in protected areas.

The third component of any effective management strategy entails avoidance. While military traffic cannot avoid all such areas, scheduling planned exercises in areas of high density archaeological material should be minimized. The current Form 88 process is, of course, an attempt to minimize damage, and it or a similar consultation procedure should continue to prove effective.

The fourth component of any strategy should involve mitigation efforts through testing and excavation. First, this work provides opportunities to learn about the variability present on post, and thereby increases the ability to more effectively sample that variability. Second, if work is concentrated in areas impacted by military training, remaining data can be salvaged. It should be entirely possible to schedule this activity so that it does not conflict with military requirements.

The last component of the suggested strategy is to design and conduct research aimed at better understanding the variability represented on the military installation. The protected areas outlined above involve the current best guess about what scale of protection may prove useful. They would not be set in stone, but subject to revision as more is learned about the archaeological record. To make those revisions, it is critical that long-term, coordinated research efforts be conducted. These would involve methodological improvement analogous to the survey project and work of a more theoretical nature.

Summary

Small sites are by far the most commonly recorded sites on Fort Bliss. There may be as many as 100,000 such occurrences on the military reservation. Yet, while they are ubiquitous, they are also the most enigmatic site class. A number of changes to the general management approach are suggested given the number of such occurrences, the lack of knowledge regarding important variability within this site type, and the ongoing impact associated with military training.

Principal among these is modification of the district strategy as a protection unit. Sites have been a critical component of the management strategy. Although the definition of sites is arbitrary, they are treated as useful analytical units. In most cases, especially with small sites, they are not. They involve many different occupations and probably a variety of tasks. Boundaries may be related to differential survey intensity and patterns of erosion. Smaller units such as hearths or clusters, which may reflect single component occupations, sometimes can be isolated. Sites should be viewed as packages of artifacts and features that represent some component of activities conducted at different times. The job, then, is to figure out what these components represent.

The central element of the 1982 management strategy uses survey data to place a representative sample of sites from various temporal and functional classes into protected districts. These temporal classes are based on the presence of diagnostic artifacts on the surface of sites. This sort of classification scheme simply will not work on small sites, and, given the patterns documented above, may not work on larger sites, because (1) the vast majority of sites lack diagnostic artifacts, (2) the frequency and spatial distribution of extant diagnostic artifacts are limited, (3) the absolute chronology on any given site may be substantially different from that reflected by the diagnostic artifacts, (4) the number of types of artifacts

present on a site is related to site size, and (5) site boundaries are determined by arbitrary definition as well as survey intensity and geomorphic processes.

A protection strategy geared to protecting a sample of different land forms and/or geomorphic units may be more appropriate. A critical component of this strategy involves developing improved surveying techniques, and using these to document both intrasite and off-site distributions of artifacts and features. Once these data are available, it should be possible to consider the distribution of material relative to major land forms, and, based on these data, select areas for protection. This survey data will also provide critical information for designing surface collection, testing, and excavation on sites that are not in the protected areas. This ongoing work, in turn, should provide data on the nature and relevance of the variability represented by small sites.

Chapter 14

SUMMARY

Project 90-11 involved the survey, surface collection, testing, and excavation of small sites in parts of 6 square kilometers in the central Hueco Bolson. The goals of the project were to generate data relevant to research and management. Research contexts involved developing data on functional, temporal, and adaptive roles of occupations in the basin. Management contexts involved developing recognitional criteria for site types and improving the effectiveness of investigative techniques.

Investigation of functional concerns suggests a pattern of variety in the project area. While ethnobotanical recovery rates were minimal, no single plant or animal appears to have been the sole target of exploitation. Artifact analysis documents a variety of general activities in the project area, but no single pattern is characteristic of these occupations.

The chronological results of the project suggest that features were primarily used—both in the study area and probably the central basin as a whole—during the late Archaic and into the early Formative period. According to regional survey data (for example, Carmichael 1986; Whalen 1978) regional population densities were at their peak during the late Formative period. Yet, judging by the patterns of radiocarbon dates, the central basin was all but abandoned during that period. This pattern of feature dates becomes even more interesting when contrasted with the results provided by obsidian hydration. A hydration rate developed by regression analysis in obsidian date patterns from the project area suggests later use of the area, concentrating in the late Mesilla phase. Two dating techniques apparently show different behavior patterns, one associated with feature production and the other associated with artifact generation at a landscape level.

The two patterns may have adaptive significance in that residential use of the central basin may have generated many of the feature dates and an unknown proportion of the artifacts. A pattern of high mobility residential foraging may be responsible for the generation of some of the occupational debris collected on the project and possibly is associated with most of the feature dates. This hunter-gather adaptation is not quantitatively different from other sites in the region at this time. It does not represent a different adaptive strategy of major fluctuations in economic orientation.

This adaptive strategy changed about 1350 B.P. when feature dates dropped off, and by 700 B.P. use of the central basin was qualitatively different. The remains left behind by this second adaptation are considerably different from the first. Scattered debris across the landscape is seen as an increasing use of the central basin as a foraging zone for resources, probably on a daily basis. Use of the area primarily as short-term residences probably shifted to one in which foragers used the area primarily for resource collection. The reason this shift occurred may be related to changes in subsistence and mobility systems at a regional scale.

Finally, suggestions for a more effective management effort include, minimally, more effective survey designs to record intrasite data and better control of erosional information. Given the lack of understanding regarding sites, some substantial modifications to the protection strategy are also suggested.

The conclusions of this project suggest radical alterations in investigation and protection of the archaeological record on Fort Bliss. These alterations are clearly applicable to small sites, and probably to all sites. Previous investigations, both on Fort Bliss and in the Jornada region as a whole, have for the most part been tied to the site and phase concepts. Yet, the data presented in this report suggest that the site concept may not be an appropriate analytical unit. The phase concept may also limit how the record is viewed. For example, features and artifact scatters may look quite similar, yet date to different cultural historical periods; features that date well into the Mesilla phase lack ceramics and do not appear different from late Archaic material. El Paso Polychrome ceramics were in the region several hundred years before the introduction of pueblo architecture. Evidence of a major adaptive change in the middle of the Mesilla phase does not seem to be accompanied by any identifiable change in artifacts.

How to proceed if the site and phase concepts are inappropriate analytical units is a problem that

essentially involves appropriate temporal and spatial scales. The process will certainly vary given the nature of the problem investigated, but this report suggests some fundamental changes in the way the archaeological record is commonly interpreted.

Two spatial scales may prove useful. The first is extremely small and involves investigation of individual features and associated artifacts. This type of investigation is similar to that conducted on several features in the present study. It involves stripping large areas—maybe 100 square meters or more—to identify patterns in artifact distributions that can be associated with features. What constitutes an association in this context will necessarily involve the recognition of repetitive patterns in artifact types and their distribution. If such repetitive patterns can be identified, then what these patterns implicate can be investigated. Patterns that do not fit previously recognized distributions also can then be investigated. This will require much work but it should provide critical data.

The second spatial scale involves comparisons of extremely large areas. Cultural systems, especially adaptations in which hunting and gathering are critical components, seem to involve extremely large areas (Lekson 1992). Most hunter-gather systems seem to have an ability to move over large areas to exploit wild plant and animal resources. The spatial confines of the central basin or even the central basin-river-mountain setting are probably much too small to pick up differences in exploitation that can provide clues to changing adaptations. Patterns hint at the possibility that certain areas, such as the playa ridge setting, were used in different ways within the central basin. Yet, these types of comparisons are limited by the lack of understanding of ecological variability and the use of the culture, phase, and site concepts. If comparative scales can be tied more tightly into ecological differences rather than locking into cultural-historical spatial units, the resulting patterns might be of even greater interest.

It may prove extremely interesting to compare the Tularosa Basin-Hueco Bolson and northern Mexico settings, which are dominated by a semidesert plant and animal community, to the upland settings of the Guadalupe, Sacramento, San Andres, and Mimbres regions. The latter has a different set of resources with different periods of availability. While these comparisons will cross-cut cultural history boundaries, this scale may be appropriate given the probable spatial scale of the adaptive systems involved.

The second component involves the temporal scale at which archaeological material is compared. An examination of the trends in radiocarbon dates suggests that the late Archaic is not a homogeneous entity that is radically different from the Mesilla phase. There appear to have been definite periods of more intensive use. Increased frequencies of dated features occurred between 4200 and 3600 B.P., between 3300 and 2850 B.P., around 2550 B.P., between 2250 B.P. and 1350 B.P., and between 1200 and 750 B.P. These peaks were separated by periods of less intensive use. While the patterns are, to some degree, part of the calibration procedure (Miller 1993b), some of these fluctuations are real, especially the radical decrease in the number of dates around 1350 B.P.

The temporal patterns in these peaks cross-cut the transitions from the middle to late Archaic period, the late Archaic to Mesilla phase, and the Mesilla to El Paso phase. A traditional phase-oriented treatment slices these periods of peak use into temporal blocks and compares the site attributes to look for trends. This obscures the pattern of variability and probably breaks up archaeological material that is adaptively similar into different units of comparison. Such an approach may prove unproductive if the goal is to document and understand variability in the archaeological record. The periods of peak use, as well as those between the peaks, may delineate different intensities of use of various locations for certain activities. By mapping the spatial extent of these temporal peaks by ecological zones the data may provide information directly relevant to both function and organization.

This is not to argue that certain cultural-historical time markers, such as the development of painted pottery around 1150 A.D. or the introduction of ceramics into the area around 250 A.D. had no adaptive significance. The development and use of ceramics probably were related to the use of new food items, a need to access different components of foods previously in use, or factors related to time stress. However, the data presented in this report suggest that ceramic technology was not an extensive use in all components of the cultural systems operating in the region before 1350 B.P. The lack of ceramics associated with many Project 90-11 Forma-

tive period features is of considerable interest. If, for example, the early use of ceramics was primarily to reconstitute stored grains, then they may have been extensively used only in sites occupied during the winter and early spring when stored foods were in greater use. Where these patterns of early ceramic use occur ecologically may provide information on subsistence change as well as on patterns of seasonality and mobility. These types of investigations are difficult if all occupations with El Paso Brown ceramics continue to be viewed as representing an internally homogeneous Mesilla phase, and all occupations without ceramics as probably reflecting an Archaic or preceramic adaptation.

To implement such an approach will be difficult. It will mean refraining from assigning sites to temporal periods by the presence of surface diagnostic artifacts. It will require working at ecological scales, acquiring chronometric information from absolute dating techniques whenever possible, and conducting comparisons based on chronometric and spatial data patterns. It will require thinking differently about the archaeological record. This will not be easy, but it should prove quite interesting.

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Appendix A

PROJECT 90 -11 HISTORICAL ARTIFACTS

by
Roger Hill and Tim Graves

Seven isolated historical artifacts were recovered during the surface collection of prehistoric sites in the project area. All the artifacts were from prehistoric sites and site boundaries were expanded to include pre-1942 items. A detailed analysis with complete descriptions of each item was conducted by Roger Hill. The following descriptions are abstracted from Hill's report:

FB7505 (41EP985)

Artifact: Nine bottle fragments

Period/Time: ca. 1880–1900

Description: The glass fragments, which are transparent pale olive green color (5YR6/4, Munsell), vary in thickness from 2.4 to 6.2 millimeters. The total weight of the fragments is 73 grams. Curvature indicates that the inside diameter of the bottle was 6.5 centimeters, while the outside was 7.5 centimeters. All the fragments were body pieces.

Condition: Fragments are weather-worn and coated with mineral patina. Less than one-fourth of the original bottle is represented by the collected pieces.

Collection: Fragments collected from the site surface in May 1991 were scattered over a relatively large area. Other pieces were noted, but not collected. None of the remaining pieces were diagnostic.

Comments: The green glass indicates that the bottle may have originally held wine. Dating of the glass is based on color, patina, thickness, and weather-worn edges of the pieces. None of the glass bears any molding imprints, thus suggesting a pre-1900 manufacturing date. As all the surfaces and edges are coated with an equal amount of patina, discard and breakage may have occurred relatively close together. The largest fragment bears an impact hole 5 millimeters in diameter. No other historical manifestations were present, which suggests that these fragments are an isolated occurrence of a single bottle.

FB10414

Artifact: Two fragments from a single bottle

Period/Time: ca. 1890–1910

Description: The glass fragments are a transparent amber color varying in thickness from 4 to 6 millimeters; total weight is 28 grams. One piece is the neck and top of the bottle and the other piece is a body fragment. The top opening is 1.8 centimeters in diameter and the top's finish is 2 centimeters long. The neck at the base of the finish is 2.5 centimeters in diameter.

Condition: Fragments are weather worn.

Collection: The neck and top piece was recovered 4 centimeters below the surface in the Feature 1 excavation area. The single collected body fragment was from the site surface approximately 25 meters north of the neck and top piece. Twenty-four small body fragments with the single collected body fragment were not collected as none were diagnostic. The bottom of the bottle was not found.

Comments: The dark amber glass and its thickness indicate that the bottle may have originally held beer. Dating of the glass fragments is based on color, worn dull edges, and manufacturing style. A small portion of the neck bears a molding imprint. Attachment marks between the top and neck are clearly visible suggesting a pre-1900 manufacturing date. The worn and dull edges of the fragments suggest the bottle has been broken for some time. No other historical manifestations occurred on the site.

FB12221

Artifact: One military mess kit knife

Period/Time: ca. 1941

Description: The complete knife consists of a blade and handle. The metal blade is 95 millimeters long, 1 millimeter thick, and 22 millimeters wide. The Bakelite handle is 90 millimeters long, 24 millimeters wide, and 7 millimeters thick; weight is 16 grams. A 2.4-by-1.2-millimeter oblong hole is in the butt end of the handle. The letters *U.S.* are stamped into the left side of the handle, while raised letters and numbers *L.F. & CI* and *1941* are on the right side.

Condition: The blade is rusted, corroded, and loose from the handle. The handle is weathered, split, and has lost its finish. A rivet pin that holds the blade and handle together is missing. Remnants of an unknown black substance, possibly paint, are present on the right forward side of the handle.

Collection: The knife was collected from the site surface.

Comments: The knife is dated according to the date of manufacture molded into the handle, though this date is not necessarily the date of loss or discard. The Bakelite of the handle is an early form of plastic. The knife most likely represents an isolated occurrence from a military training exercise.

FB12229

Artifact: U.S. penny

Period/Time: 1919

Description: The coin is a dark reddish brown copper-colored U.S. penny dated 1919. The letter *S* below the date indicates the coin was minted in San Francisco, California.

Condition: The coin's surface is coated with oxidation patina. Much of the relief detail on both sides of the coin has been worn off from handling.

Collection: The coin was collected from the site surface.

Comments: Dating of this coin is from the date on the coin and represents the mint date and not the date of discard or loss. Investigations of the location where the penny was recovered revealed a 1934 Springfield shell casing (30.06 blank training ammunition) and an associated badly rusted tin can. These were not collected. The historical artifacts were in an area of the site disturbed by army maneuvers and training. The presence of these materials along with the penny and the fact that old training ammunition only had a shelf-life of five years suggest that a historic component of a military training exercise was present between 1934 and 1939.

FB12330

Artifacts: One hole-in-top can and two possible fragmented similar cans

Descriptions: The hole-in-top can is complete and measures 10 centimeters tall and 7.5 centimeters in diameter; weight is 42 grams. One end (the top?) has a small hole in the center, which has been soldered shut. The can was assembled by placing a cap over each end and sealing them with solder. The other two cans are the same size measuring 10.5 centimeters tall and approximately 13 centimeters in diameter; combined weight is 56 grams. Body seams have been soldered.

Conditions: The complete can is rusted and corroded. Both end caps have holes in them where a small portion of the can has corroded away. The end opposite the soldered hole end had two holes punched into it for draining the contents. The other cans are both rusted and corroded. Each had been crushed and all four end caps are missing. Portions of the body of these cans are also missing making a determination of possible contents impossible.

Collection: The two crushed cans were collected from the site surface near the Feature 7 excavation area and the complete can was collected subsurface in Level 1 of the Feature 7 excavation area.

Comments: Dating of the cans is based upon the style of manufacture. A single layer soldered overlap seam indicates a possible manufacturing date sometime between 1900 and 1920. The size and method of opening (small punctures) of the intact can suggest it may have held condensed milk. No other historic materials were present on the site, though a possible 1930s army truck wreckage was near the site. This truck was possibly used as a firing target in the late 1930s or early 1940s.

Appendix B

CENTRAL AREA SITE SURVEY DATA

Figure B1 provides a map of the central survey area with site distributions and site numbers assigned for each of the grid quads surveyed. All survey in this area was done at 15-meter spacing between individuals, and 87 sites were recorded. Tables B1 and B2 provide information on each of the 87 sites recorded. Additional data is on file at the Directorate of the Environment, Conservation Division, Fort Bliss, Texas. All sites are in El Paso County, Texas.

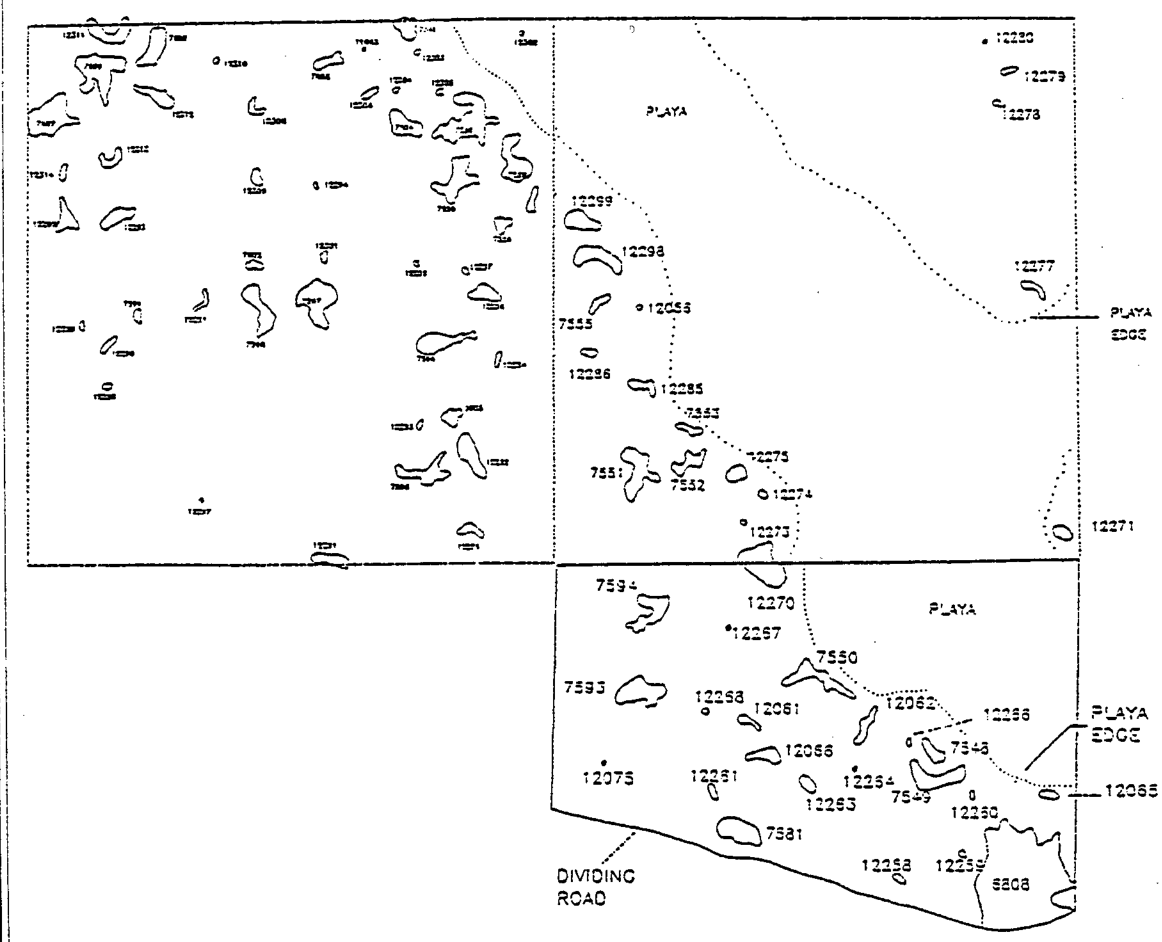


Figure B1. Sites in Central Survey Area.

Table B1. Site Information Central Survey Area.

FB Site No.	Elevation	Vegetation	Soil	Erosion	No. of Features	Site Size (sq. m)	Period/ Phase
6808	4,012	Mesquite, four-wing saltbush	Sand	High	8	28,511	El Paso
7548	4,005	Mesquite, four-wing saltbush	Sand	Unknown	1	910	Unknown
7549	4,007	Mesquite, four-wing saltbush	Sand	Unknown	3	3,078	Unknown
7550	4,007	Mesquite, four-wing saltbush	Sand	Unknown	6	2,969	Formative
7551	4,005	Mesquite, four-wing saltbush	Sand	Moderate	7	2,978	Formative
7552	3,995	Mesquite, four-wing saltbush	Sand	Unknown	2	1,334	Formative
7553	3,995	Mesquite, four-wing saltbush	Sand	Unknown	0	637	Unknown
7555	3,995	Mesquite, four-wing saltbush	Sand	Unknown	0	622	Unknown
7556	4,000	Mesquite	Sand	Unknown	2	725	Unknown
7558	3,985	Mesquite	Sand	Unknown	1	3,052	Unknown
7559	3,995	Mesquite	Sand	Unknown	4	3,429	El Paso
7560	3,990	Mesquite	Sand	Unknown	13	5,677	Unknown
7561	3,990	Other	Sand	Unknown	2	1,373	Unknown
7581	4,007	Mesquite	Sand	Unknown	3	2,980	Unknown
7593	4,005	Mesquite, four-wing saltbush	Sand	Low	0	3,290	Unknown
7594	4,009	Mesquite	Sand	Unknown	2	2,520	Unknown
7595	4,004	Mesquite	Sand	Low	4	2,718	Unknown
7596	4,005	Mesquite	Sand	Unknown	0	2,621	Unknown
7597	4,000	Mesquite	Sand	Unknown	7	4,048	Archaic
7598	3,998	Mesquite	Sand	Low	3	2,560	Formative
7599	3,996	Mesquite	Sand	Unknown	1	381	Unknown
7602	4,000	Mesquite	Sand	Unknown	2	489	Unknown
7604	4,000	Mesquite	Sand	Unknown	2	2,074	Unknown
7605	4,000	Mesquite	Sand	Unknown	1	828	Unknown
7607	4,000	Mesquite	Sand	Unknown	5	4,477	Unknown
7608	4,000	Other	Sand	Low	3	2,346	Unknown
7609	4,000	Mesquite	Sand	Low	4	4,679	Unknown
9005	4,004	Mesquite	Sand	Unknown	0	939	Unknown
11063	4,000	Mesquite	Sand	Unknown	1	53	Unknown
12056	4,003	Mesquite, four-wing saltbush	Sand	Unknown	1	86	Unknown
12061	4,007	Mesquite	Sand	Unknown	2	517	Unknown
12062	4,005	Mesquite, four-wing saltbush	Sand	Unknown	1	1,088	Unknown
12065	4,006	Mesquite, four-wing saltbush	Sand	Unknown	1	468	Unknown
12066	4,009	Mesquite	Sand/caliche	Unknown	4	1,233	Unknown

(Continued on next page.)

Table B1. Site Information Central Survey Area (continued).

Site No.	Elevation	Vegetation	Soil	Erosion	No. of Features	Site Size (sq. m)	Period/ Phase
12075	4,005	Mesquite	Sand	Unknown	1	49	Unknown
12258	4,010	Mesquite, grass	Sand/caliche	Moderate	1	321	Unknown
12259	4,010	Grass, mesquite	Sand	Low	1	225	Unknown
12260	4,008	Other	Sand	Low	1	125	Unknown
12261	4,007	Mesquite, grass	Sand/caliche	Low	2	387	Unknown
12263	4,009	Mesquite, grass	Sand/caliche	Low	1	743	Unknown
12264	4,010	Mesquite, grass	Sand/caliche	Low	1	58	Unknown
12266	4,007	Grass, mesquite	Sand	Low	1	122	Unknown
12267	4,007	Mesquite, grass	Sand/caliche	Low	1	45	Unknown
12268	4,007	Grass, mesquite	Sand	Low	1	112	Unknown
12270	4,006	Mesquite, grass	Sand/caliche	Moderate	4	4,564	Formative
12271	3,980	Grass, mesquite	Sand	Low	0	738	Unknown
12273	4,006	Mesquite, grass	Sand	Low	0	81	Unknown
12274	4,006	Mesquite, grass	Sand/caliche	Low	1	222	Unknown
12275	4,005	Grass, mesquite	Sand	Low	1	918	Unknown
12276	4,004	Mesquite	Sand	Unknown	1	768	Unknown
12277	3,986	Mesquite, grass	Sand/caliche	Low	0	607	Formative
12278	3,987	Grass, mesquite	Sand	Low	1	198	Unknown
12279	3,985	Mesquite, grass	Sand/caliche	Low	1	316	Formative
12280	3,987	Mesquite, grass	Sand	Low	1	45	Unknown
12281	4,002	Mesquite, grass	Sand	Low	0	1,286	Formative
12282	4,003	Mesquite, grass	Sand/caliche	Low	0	2,581	Unknown
12283	4,003	Mesquite, grass	Sand	Low	0	112	Unknown
12284	4,001	Mesquite, grass	Sand/caliche	Low	1	286	Unknown
12285	4,006	Mesquite, four-wing saltbush	Sand	Low	1	806	Unknown
12286	4,005	Mesquite, grass	Sand/caliche	Low	0	381	Unknown
12287	3,997	Mesquite, grass	Sand/caliche	Low	1	53	Unknown
12288	3,994	Mesquite, grass	Sand/caliche	Low	1	187	Unknown
12289	3,994	Mesquite, grass	Sand/caliche	Low	1	149	Unknown
12290	3,995	Mesquite, grass	Sand	Low	0	423	Unknown
12291	3,998	Mesquite, grass	Sand/caliche	Low	0	449	Unknown
12292	3,997	Grass, mesquite	Sand	Low	3	1,389	Unknown
12293	3,997	Mesquite, grass	Sand/caliche	Low	0	1,489	Unknown
12294	4,003	Mesquite, grass	Sand	Low	1	89	Unknown

(Continued on next page.)

Table B1. Site Information Central Survey Area (continued).

Site No.	Eleva- tion	Vegetation	Soil	Erosion	No. of Features	Site Size (sq. m)	Period/ Phase
12295	4,003	Mesquite, grass	Sand	Low	1	87	Unknown
12296	4,005	Mesquite, grass	Sand	Low	1	1,539	Unknown
12297	4,004	Mesquite, grass	Sand/caliche	Low	0	189	Formative
12298	4,003	Mesquite, other	Sand	Low	4	2,389	Formative
12299	4,000	Grass, mesquite	Sand	Low	2	1,756	Unknown
12300	4,002	Mesquite, grass	Sand	Unknown	0	599	Unknown
12301	4,000	Mesquite	Sand	Unknown	0	168	Unknown
12302	3,985	Mesquite, grass	Sand	Unknown	1	70	Unknown
12303	3,995	Mesquite, grass	Sand	Low	1	93	Unknown
12304	4,000	Mesquite, grass	Sand	Unknown	1	115	Unknown
12305	4,000	Mesquite, grass	Sand	Unknown	1	58	Unknown
12306	4,003	Mesquite, grass	Sand	Low	1	389	Unknown
12308	4,000	Grass, mesquite	Sand	Low	1	538	Unknown
12309	4,002	Mesquite, grass	Sand/caliche	Low	0	498	El Paso
12310	4,002	Mesquite, grass	Sand/caliche	Low	1	113	Unknown
12311	4,001	Mesquite, grass	Sand/caliche	Low	3	1,590	Unknown
12312	4,003	Mesquite, grass	Sand	Low	2	1,539	Formative
12313	4,000	Mesquite, grass	Sand/caliche	Low	0	869	Unknown
12314	3,997	Grass, mesquite	Sand	Unknown	0	320	Unknown

Table B2. Site Level Artifacts in Central Survey Area.

Site No.	UB	EPP	Deb.	Flake	Util. Fl.	Uni. Marg.	Bi. Marg.	Uni. Ret.	Bi-face	Proj. Pt.	Core	Hm. stn.	Mano	Metate	Ukn. GS
6808	X	X	X	X	–	X	–	–	X	–	X	–	–	X	X
7548	–	–	–	X	–	X	–	–	–	–	–	–	–	–	–
7549	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X
7550	X	–	–	X	–	–	–	–	–	–	–	–	–	–	X
7551	X	–	–	X	–	–	–	–	–	–	–	X	–	–	X
7552	X	–	X	–	–	–	–	–	–	–	X	–	–	–	–
7553	X	–	–	–	–	–	–	–	–	–	–	–	–	–	X
7555	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–
7556	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X
7558	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X

UB — *Undifferentiated brownware*
EPP — *El Paso Polychrome*
Deb. — *Debris*
Util. Fl. — *Utilized flake*
Uni. Marg. — *Unimarginal retouch*
Bi. Marg. — *Bimarginal retouch*
Uni. Ret. — *Unifacial retouch*
Proj. Pt. — *Projectile point*
Hm. stn. — *Hammerstone*
Ukn. GS — *Unknown ground stone*

(Continued on next page)

Table B2. Site Level Artifacts in Central Survey Area (continued).

Site No.	UB	EPP	Deb.	Flake	Util. Fl.	Uni. Marg.	Bi. Marg.	Uni. Ret.	Bi-face	Proj. Pt.	Core	Hm. stn.	Mano	Metate	Ukn. GS
7559	–	X	–	X	–	–	–	–	–	–	–	X	–	–	X
7560	–	–	X	X	–	X	–	–	–	–	X	–	X	X	X
7561	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
7581	–	–	–	X	–	–	–	–	–	–	–	X	–	X	X
7593	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X
7594	–	–	–	X	–	–	X	–	–	–	–	–	–	–	X
7595	–	–	–	X	–	–	–	–	–	–	–	X	–	–	X
7596	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
7597	–	–	X	X	–	–	–	–	–	X	X	–	X	–	X
7598	X	–	–	X	–	–	–	–	–	–	X		–	–	X
7599	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
7602	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7604	–	–	–	X	–	X	–	–	–	–	X	–	–	–	X
7605	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–
7607	–	–	–	X	–	X	–	–	–	–	X	–	X	–	–
7608	–	–	–	X	–	X	–	–	–	–	–	X	–	–	X
7609	–	–	X	X	–	–	–	–	–	–	X	X	–	–	X
9005	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X
11063	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12056	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12061	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X
12062	–	–	–	X		–	–	–	–	–	–	–	–	–	X
12065	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12066	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X
12075	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12258	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12259	–	–	–	–	–	X	–	–	–	–	–	–	–	–	–
12260	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12261	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12263	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–
12264	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12266	–	–	–	–	–	X	–	–	–	–	–	–	–	–	–
12267	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12268	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12270	X	–	X	X	–	–	–	–	–	–	–	–	–	–	X
12271	–	–	X	–	–	–	–	–	–	–	–	–	–	–	X
12273	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12274	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12275	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X

(Continued on next page)

Table B2. Site Level Artifacts in Central Survey Area (continued).

Site No.	UB	EPP	Deb.	Flake	Util. Fl.	Uni. Marg.	Bi. Marg.	Uni. Ret.	Bi-face	Proj. Pt.	Core	Hm. stn.	Mano	Metate	Ukn. GS
12276	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12277	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12278	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
12279	X	X	–	X	–	–	–	–	–	–	–	–	–	–	–
12280	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12281	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–
12282	–	–	X	X	–	–	–	–	–	–	X	–	X	X	X
12283	–	–	–	X	–	–	–	–	–	–	X	–	–	–	–
12284	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12285	–	–	–	X	–	–	–	–	–	–	X	X	–	X	–
12286	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X
12287	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12288	–	–	–	–	–	–	–	–	–	–	–	–	–	X	–
12289	–	–	–	–	–	–	–	–	–	–	–	–	–	–	X
12290	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X
12291	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X
12292	–	–	–	–	–	X	–	–	–	–	–	–	–	X	X
12293	–	–	X	X	X	–	–	X	–	–	–	–	–	–	–
12294	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12295	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12296	–	–	–	X	–	–	–	–	–	–	–	X	–	–	–
12297	X	–	X	–	–	–	–	–	–	–	–	–	–	–	–
12298	X	–	–	X	–	–	–	–	–	–	X	X	–	–	X
12299	–	–	–	X	–	–	–	–	–	–	–	–	–	–	–
12300	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–
12301	–	–	–	X	–	–	–	X	–	–	X	–	–	–	–
12302	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12303	–	–	–	X	–	–	–	X	–	–	–	–	–	–	–
12304	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12305	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12306	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12308	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
12309	X	X	–	X	–	X	–	–	–	–	–	–	–	–	–
12310	–	–	–	–	–	–	–	–	–	–	X	–	–	–	–
12311	–	–	–	X	–	–	–	–	–	–	X	–	–	–	X
12312	X	–	–	X	–	–	–	–	–	–	–	–	–	–	–
12313	–	–	–	X	–	–	–	–	–	–	–	–	–	–	X
12314	–	–	–	–	–	–	–	–	–	–	X	–	–	–	X

Appendix C

SITE DESCRIPTIONS AND STATUS

The following tables and maps provide information on each of the 89 sites located in the southern and northern survey areas of Project 90-11. The description of each site contains all material used to assign that site to a time period, including radiocarbon and obsidian hydration dates, and diagnostic artifact types. The size of the site, degree of erosion, degree of modern disturbance, number of surface features, total number of features, number of features tested, and the types of features recorded are listed as well. These descriptions also provide the number of square meters tested and the number of surface and subsurface artifacts collected. Finally, a table listing the feature number, the east and north provenience, a feature type designation, a notation if the feature was tested, and the condition of the feature. Feature condition, which ranges from 1 (no excavation potential) to 9 (high excavation potential) was estimated based on the degree of erosion, the presence of a stain, and the degree of articulation of fire-cracked rock in the case of fire-cracked rock features.

Each site has an accompanying surface sketch map drawn from aerial photos. On all maps, magnetic north is used. All distances and scales are metric. In several cases the site boundary extends beyond the UTM grid lines that define the project boundary. While these were frequently mapped, they are not included in the site descriptions except in specific cases.

All surface features are drawn on the surface map. The feature description information can be tied into specific features by the provenience information provided in the site descriptions. On those sites where subsurface testing was conducted, a second map showing the location of excavation units and backhoe trenches is provided.

All obsidian date data include lab number, provenience, level, rim width, and time period. Lab number is the specimen number from Archeological Services Consultants (Appendix A). Rim measurements were made by Dr. Chris Stevenson of Archeological Services Consultants. The time period is the estimated phase for the obsidian rim measurements using conversions discussed in Chapter 11. Date ranges used for this designation are: Middle Archaic (4000–2000 B.C.), Late Archaic (2000 B.C.–A.D. 250), Mesilla Phase (A.D. 250–1150), El Paso Phase (A.D. 1150–1450), and Protohistoric (A.D. 1450–1600).

All surface artifacts from each of the 89 sites were collected within the project boundary during Phase II of the project between March 23, 1990 and January 16, 1991. Surface artifacts outside the project boundary on defined project sites were not collected except from FB10416 and FB10417.

Additional surface artifacts were collected during Phase III (April 29, 1991 to November 3, 1991) on all sites recommended for mitigation. On sites not recommended for mitigation, though additional testing was conducted, artifacts were occasionally surface collected a second time or if additional cultural materials were present.

Three recommendations are presented in this appendix. The first (Table C1) includes 37 sites on which no significant data remain. A second group (Table C2) identifies 35 sites that still have significant data. The third group (Table C3), identifies 17 sites where additional testing will be required to assess the data potential. Each site description contains one of the following codes that identifies its management status: Status 1, sites with significant data remaining; Status 2, sites on which additional testing is required to assess data potential; and Status 3, sites with no significant data. Status 3 sites may continue outside the project area, however, into areas that were not mitigated.

Table C1. Sites with No Significant Data Remaining (Status = 3).

FB No.	Survey Area	Testing/ Excavation	FB No.	Survey Area	Testing/ Excavation
10407	North	No	12228	South	Yes
10408	North	Yes	12240	South	Yes
10409	North	Yes	12246	South	No
10412	North	Yes	12253	South	Yes
10413	North	Yes	12254	South	No
10414	North	Yes	12255	South	No
10415	North	No	12256	South	Yes
10416	North	Yes	12316	North	Yes
10418	North	No	12317	North	No
10419	North	No	12318	North	Yes
10420	North	Yes	12319	North	Yes
12090	North	No	12321	North	Yes
12092	North	No	12324	North	Yes
12093	South	Yes	12326	North	Yes
12095	South	Yes	12327	North	Yes
12097	South	Yes	12329	North	Yes
12213	South	Yes	12330	North	Yes
12216	South	Yes	12331	North	Yes
12227	South	Yes			

Table C2. Sites with Significant Data Remaining (Status 1).

FB No.	Survey Area	Testing/ Excavation	FB No.	Survey Area	Testing/ Excavation
6741	South	Yes	12096	South	Yes
7483	South	Yes	12100	South	Yes
7484	South	Yes	12102	South	Yes
7505	South	Yes	12221	South	Yes
7508	South	Yes	12225	South	Yes
7510	South	Yes	12229	South	Yes
7517	South	Yes	12233	South	Yes
7520	South	Yes	12235	South	No
7547	South	Yes	12239	South	Yes
7569	South	Yes	12241	South	No
7580	South	Yes	12243	South	Yes
7583	South	No	12245	South	Yes
10411	North	Yes	12247	South	No
10417	North	Yes	12248	South	No
11299	South	Yes	12249	South	No
12017	South	Yes	12252	South	No
12069	South	Yes	12320	North	Yes
12072	South	Yes			

Table C3. Sites that Require Additional Testing (Status 2).

FB No.	Survey Area	Testing/ Excavation	FB No.	Survey Area	Testing/ Excavation
7252	North	No	12222	South	No
10410	North	No	12223	South	No
11298	South	Yes	12224	South	Yes
12091	South	No	12226	South	Yes
12214	South	Yes	12230	South	Yes
12217	South	Yes	12231	South	Yes
12218	South	Yes	12234	South	Yes
12219	South	Yes	12237	South	Yes
12220	South	No			

FB6741 (41EP1028)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43195	7	2270 ± 50	407–200 B.C.	Late Archaic
43196	152	2330 ± 80	762–210 B.C.	Late Archaic
50086	135	4010 ± 70	2854–2365 B.C.	Middle Archaic
50087	135	3950 ± 80		

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-91-452	509	212	5	7.77	Late Archaic
				5.81	Late Archaic
DL-91-462	510	200	2	4.17	Mesilla phase
DL-91-463	277	316	1	2.65	El Paso phase/Mesilla phase
DL-92-15	402	242	0	1.88	Protohistoric/El Paso phase
DL-92-16	112	195	0	4.70	Mesilla phase/Late Archaic
				2.91	Mesilla phase/El Paso phase
DL-92-17	575	237	0	3.19	Mesilla phase
DL-92-18	305	191	0	4.47	Mesilla phase
DL-92-19	317	172	0	2.34	El Paso phase/Protohistoric
DL-92-20	277	309	0	3.99	Mesilla phase
DL-92-21	152	175	0	3.91	Mesilla phase
				3.47	Mesilla phase
DL-92-22	519	207	0	5.28	Late Archaic/Mesilla phase
				4.17	Mesilla phase
DL-92-23	312	243	0	2.11	El Paso phase/Protohistoric
DL-92-24	303	248	0	6.31	Late Archaic
DL-92-25	280	123	0	3.96	Mesilla phase
DL-92-179	306	132	1	5.14	Late Archaic/Mesilla phase
DL-92-358	270	102	0	3.16	Mesilla phase/El Paso phase
DL-92-359	267	181	0	3.12	Mesilla phase/El Paso phase
DL-92-360	313	186	0	3.88	Mesilla phase
DL-92-361	392	179	0	5.25	Late Archaic/Mesilla phase
DL-92-362	347	240	0	2.87	Mesilla phase/El Paso phase
DL-92-363	313	239	0	2.98	Mesilla phase/El Paso phase
DL-92-364	272	311	0	2.95	Mesilla phase/El Paso phase
DL-92-365	271	303	0	3.56	Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
El Paso Brown rim	A.D. 250–1150	Mesilla phase
Projectile point	A.D. 1150–1450	El Paso phase
Projectile point	2000 B.C.–A.D. 1150	Late Archaic to Mesilla phase

Size (meters): 82,212

Erosion: Low

Modern Disturbance: Low

Surface Features:	138	Surface Artifacts:	1,680
Total Features:	159	Tested Features:	31

Feature Types (excavated number in parentheses):

Burned caliche	94	(12)
Fire-cracked rock	4	(1)
Burned caliche/fire-cracked rock	35	(10)
Small stain	23	(8)
Large stain	1	(0)
Other:	2	(0)

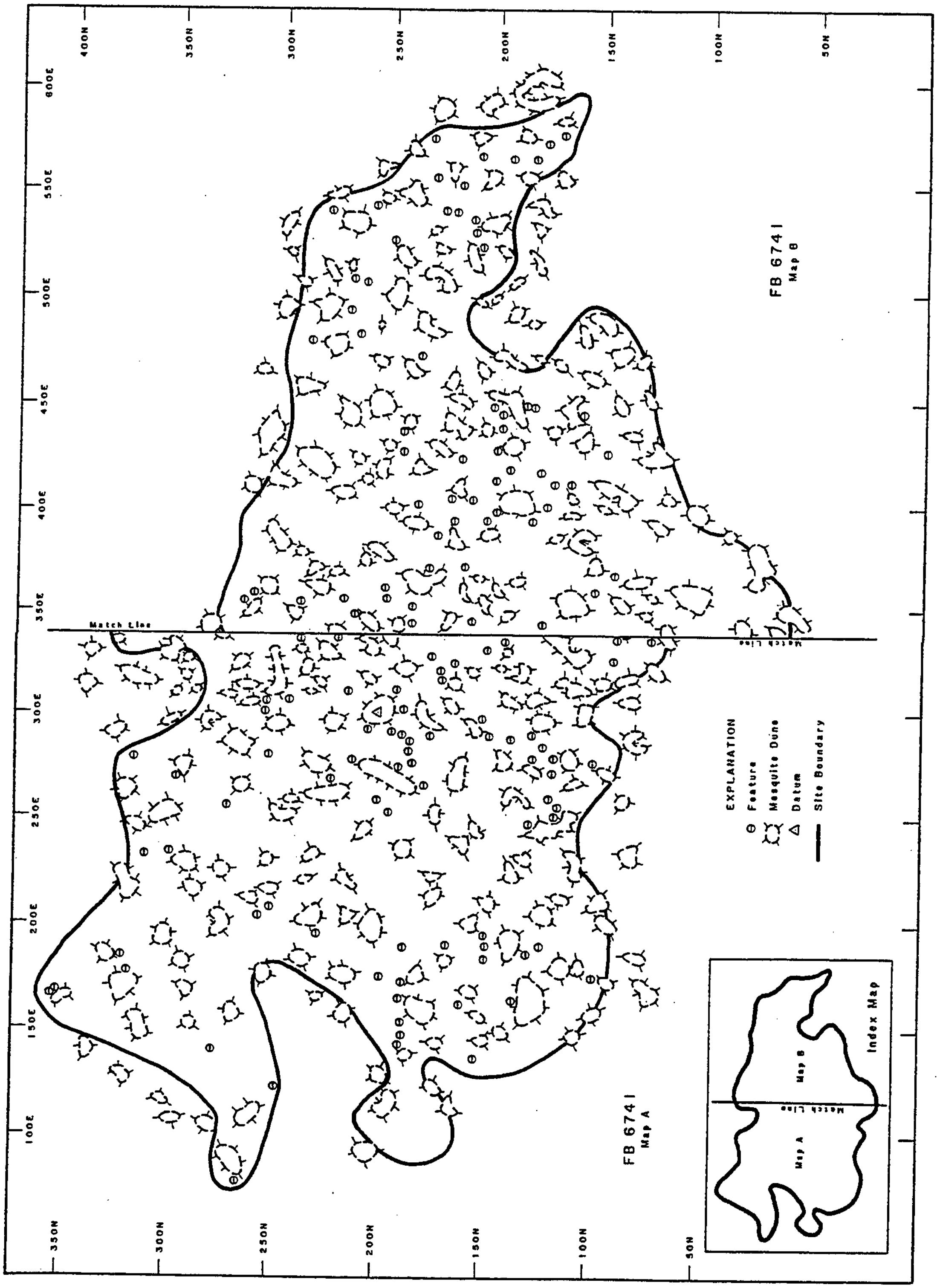
Square Meters Tested: 314 Subsurface Artifacts: 394
Unique Artifacts: One olivella shell (worked)

Several excavation methods were employed on this site. Four of the 49 1-by-1-meter units in southernmost project grid quad were within FB6741. An additional 70 judgmentally placed 1-by-1-meter units were excavated on the site. Finally, 13 block excavations were placed in various areas of the site to test selected features:

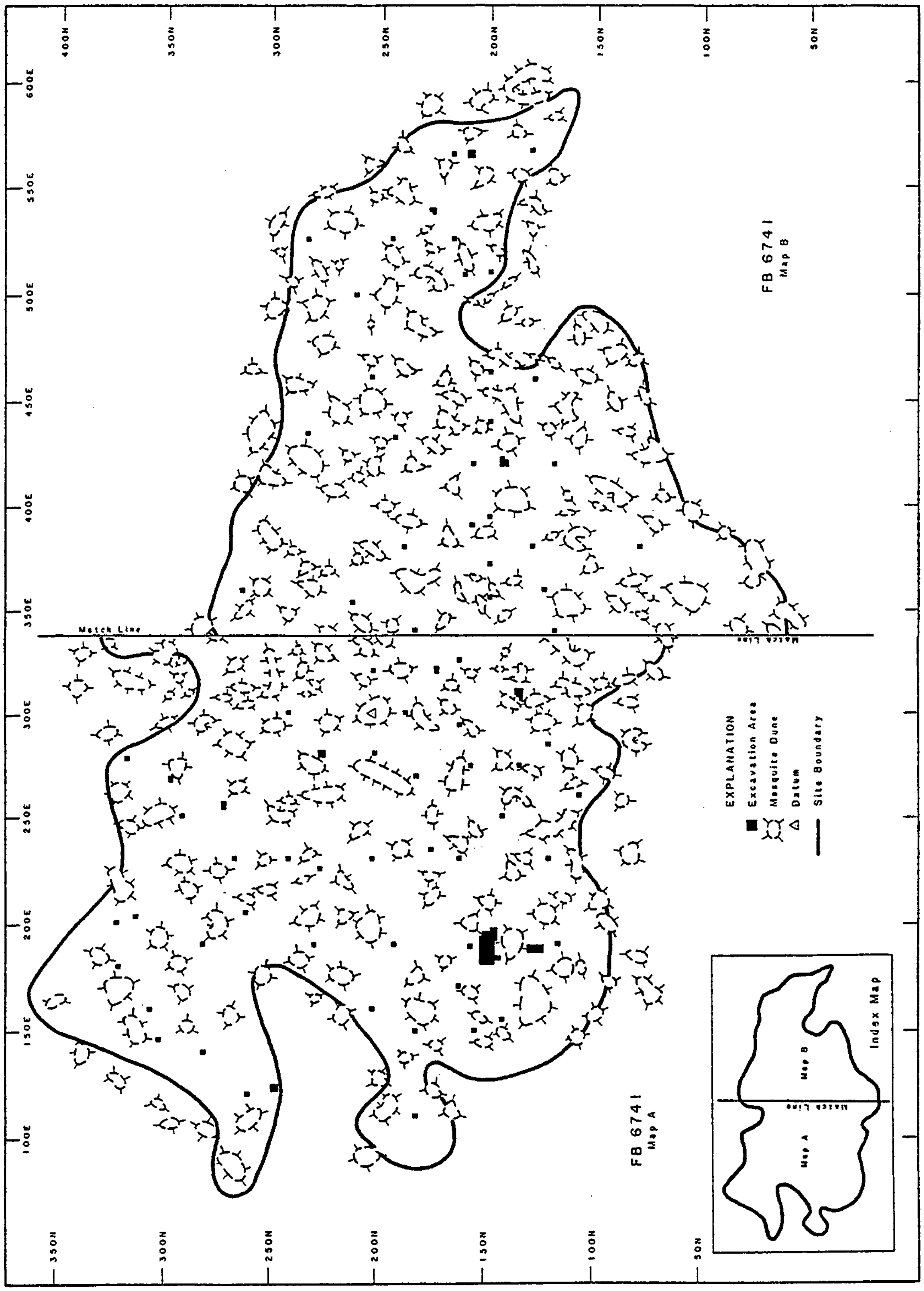
126 meters over Features 5–7, southwest area
28 square meters over Features 2 and 3, southwest area
19 square meters over Feature 135, south-central area
9 square meters over Feature 156, south-central area
11 square meters over Features 69 and 158, southeast-central area
9 square meters over Feature 133, southeast area
8 square meters over Feature 145, east area
9 meters over Feature 134, central area
3 6-square-meter blocks over Features 100, 102, and 106, northwest area
4 square meters over Feature 144, north-central area
1-by-1-meter unit over Feature 159, central area

Work on FB6741 suggests considerable research potential remains. Cultural materials were constantly being exposed and surface artifacts were collected several times. Results from the excavation of 74 1-by-1-meter test units revealed a high frequency of subsurface material. Forty-four test units contained subsurface artifacts or charcoal, and 6 subsurface features were uncovered. Features uncovered subsurface, though not tested include Feature 138, Feature 139, Feature 140, and Feature 146. Several of the 1-by-1-meter units also contained cultural materials at various depths indicating multiple horizons may be present at the site. Cultural material was also recovered from the block excavations, with the largest of these having nine subsurface features. Block excavations did not exhaust the research potential of the areas excavated, and testing revealed significant research potential remains.

Feature No.	East	North	Type	Tested	Condition
1	175	98	Small stain <1 meter	No	1
2	189	122	Burned caliche	Yes	0
3	186	128	Burned caliche	Yes	0
4	164	134	Burned caliche	No	3
5	183	148	Burned caliche	Yes	0
6	190	148	Burned caliche	Yes	0
7	195	148	Small stain <1 meter	Yes	0
8	190	167	Small stain <1 meter	No	2
9	189	187	Burned caliche	No	3
10	172	187	Burned caliche with stain	No	4
11	165	188	Burned caliche with stain	No	4
12	162	160	Small stain <1 meter	No	1
13	136	153	Burned caliche with stain	No	4
14	143	188	Burned caliche with stain	No	3



Site FB6741 (41EP1028) Features.



Site FB6741 (41EP1028) Excavation Areas.

15	147	187	Burned caliche	No	4
16	153	187	Burned caliche	No	3
17	175	197	Burned caliche	No	4
18	252	194	Fire-cracked rock	No	5
19	258	200	Burned caliche/fire-cracked rock	No	4
20	265	178	Burned caliche	No	3
21	250	116	Burned caliche/fire-cracked rock	No	4
22	255	115	Burned caliche/fire-cracked rock/stain	No	4
23	247	128	Burned caliche	No	4
24	259	119	Burned caliche/fire-cracked rock/stain	No	4
25	276	99	Burned caliche	No	2
26	289	126	Burned caliche	No	4
27	285	122	Burned caliche	No	4
28	271	117	Burned caliche/fire-cracked rock	No	3
29	278	116	Burned caliche/fire-cracked rock	No	2
30	278	126	Burned caliche	No	2
31	287	136	Burned caliche	No	3
32	288	146	Burned caliche/fire-cracked rock	No	4
33	297	150	Burned caliche	No	5
34	275	184	Burned caliche	No	4
35	274	190	Burned caliche	No	5
36	286	185	Burned caliche/fire-cracked rock	No	5
37	289	189	Burned caliche/fire-cracked rock	No	5
38	302	188	Burned caliche/fire-cracked rock	No	5
39	292	205	Small stain <1 meter	No	5
40	311	191	Burned caliche	No	4
41	324	164	Burned caliche	No	4
42	277	212	Burned caliche/fire-cracked rock	No	3
44	327	175	Burned caliche/fire-cracked rock	No	0
45	288	175	Burned caliche/fire-cracked rock	No	4
46	167	353	Other	No	6
47	330	148	Burned caliche	No	4
48	334	140	Burned caliche	No	4
49	335	88	Burned caliche	No	4
50	335	72	Burned caliche	No	4
51	325	90	Burned caliche	No	4
53	367	145	Burned caliche/fire-cracked rock	No	5
54	359	154	Burned caliche/fire-cracked rock	No	5
55	444	160	Burned caliche	No	4
56	342	177	Burned caliche	No	5
57	448	183	Burned caliche	No	4
58	449	186	Burned caliche/fire-cracked rock	No	4
59	393	183	Burned caliche	No	4
60	401	176	Burned caliche	No	4
61	412	173	Fire-cracked rock with stain	No	2
62	412	162	Burned caliche/fire-cracked rock	No	5
63	427	148	Burned caliche	No	5
64	448	202	Burned caliche	No	5
65	445	197	Burned caliche	No	4
66	438	197	Burned caliche	No	1
67	428	199	Burned caliche	No	3

68	413	200	Burned caliche	No	4
69	418	193	Burned caliche with stain	Yes	5
70	417	179	Burned caliche	No	4
71	398	200	Burned caliche	No	3
72	394	204	Burned caliche	No	4
73	394	220	Burned caliche	No	4
74	371	215	Burned caliche	No	4
75	424	217	Burned caliche	No	3
76	436	245	Burned caliche	No	5
77	404	211	Burned caliche/fire-cracked rock	No	5
78	404	222	Burned caliche	No	1
79	427	245	Small stain <1 meter	No	0
80	402	238	Large stain >1 meter	No	3
81	336	237	Burned caliche/fire-cracked rock	No	5
82	343	240	Burned caliche	No	4
83	355	252	Burned caliche	No	4
84	387	238	Burned caliche	No	4
85	336	219	Burned caliche	No	4
86	356	272	Burned caliche with stain	No	3
87	348	267	Burned caliche	No	5
88	354	292	Burned caliche	No	3
89	361	253	Burned caliche	No	4
90	344	211	Burned caliche/fire-cracked rock	No	4
91	355	319	Burned caliche	No	4
92	358	314	Burned caliche	No	4
93	306	242	Burned caliche	No	4
94	310	214	Burned caliche	No	4
95	305	252	Burned caliche	No	4
96	300	253	Burned caliche	No	4
97	196	227	Small stain <1 meter	No	5
98	208	250	Burned caliche	No	4
99	204	255	Fire-cracked rock	No	6
100	255	271	Small stain <1 meter	Yes	5
101	279	251	Burned caliche	No	3
102	268	296	Burned caliche	Yes	5
103	234	298	Burned caliche	No	5
104	233	310	Burned caliche	No	4
105	140	277	Burned caliche	No	5
106	123	246	Burned caliche/fire-cracked rock	Yes	7
107	178	318	Small stain <1 meter	No	4
108	185	320	Burned caliche with stain	No	4
109	167	354	Burned caliche/fire-cracked rock	No	6
110	371	232	Small stain <1 meter	No	0
111	522	208	Burned caliche	No	5
112	535	212	Burned caliche	No	5
113	529	211	Burned caliche	No	4
114	539	221	Burned caliche	No	5
115	552	218	Burned caliche/fire-cracked rock	No	4
116	555	231	Burned caliche/fire-cracked rock	No	6
117	574	232	Small stain <1 meter	No	4
118	564	183	Burned caliche	No	4

119	572	178	Small stain <1 meter	No	3
120	540	280	Burned caliche	No	4
121	525	249	Burned caliche with stain	No	6
122	542	259	Burned caliche	No	4
123	507	269	Burned caliche	No	4
124	493	271	Burned caliche/fire-cracked rock	No	4
125	506	263	Burned caliche/fire-cracked rock	No	4
126	482	267	Other	No	0
127	479	289	Burned caliche	No	5
128	472	237	Burned caliche	No	6
129	268	222	Burned caliche with stain	No	5
131	78	264	Burned caliche	No	3
132	564	194	Burned caliche with stain	No	6
133	565	208	Burned caliche	Yes	5
141	281	185	Burned caliche	No	5
142	290	193	Burned caliche	No	4
143	576	170	Burned caliche	No	4
144	278	316	Small stain <1 meter	Yes	5
145	539	227	Small stain <1 meter	Yes	7
156	315	170	Burned caliche/fire-cracked rock	Yes	3
157	320	171	Small stain <1 meter	No	0
159	392	207	Small stain <1 meter	Yes	6

FB7252 (41EP1832)

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 139

Erosion: Low		Modern Disturbance: Low	
Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	0

Feature Types:

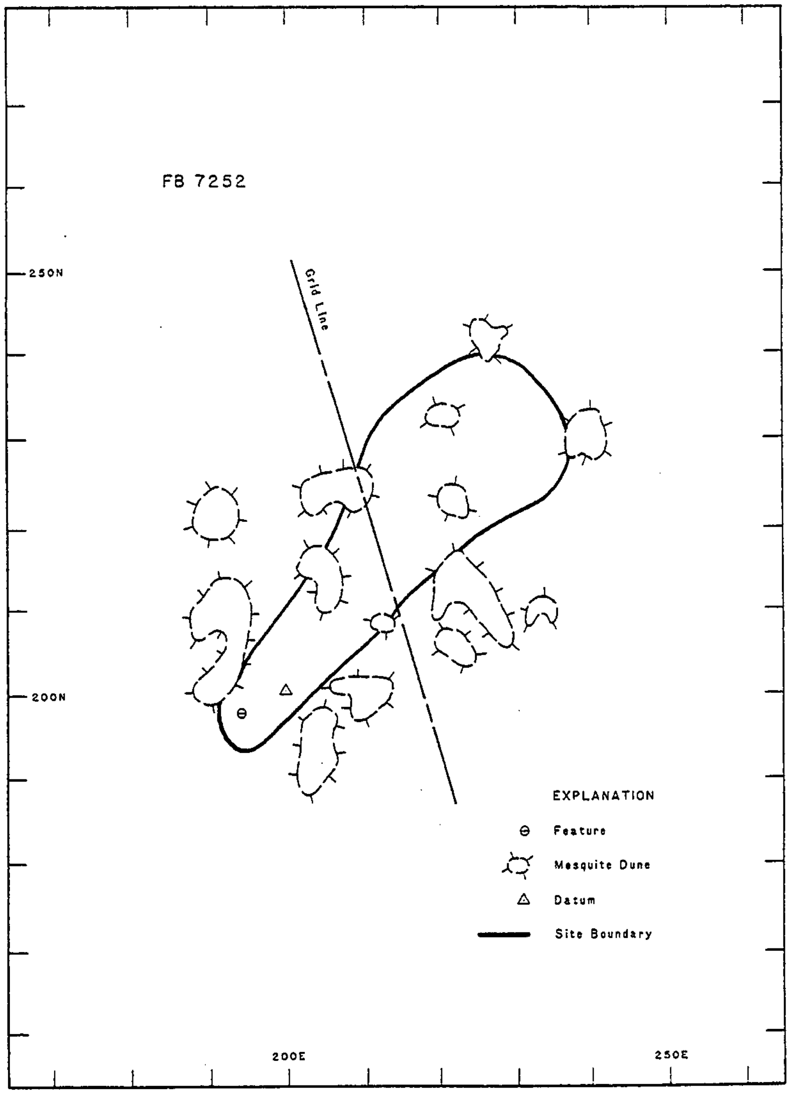
Burned Caliche: 1

Square Meters Tested: 0 Subsurface Artifacts: 0

FB7252 was predominately located outside the project boundary. A single burned caliche feature was documented in the project area. The site was not tested given its location at the east edge of north grid quad. Four additional surface features and some artifacts were in adjoining grid to the east. FB7252 still contains significant data given the site area and surface features were not tested. Surface deflation was minimal and may indicate additional subsurface cultural material.

Feature:

Feature No.	East	North	Type	Tested	Condition
1	199	197	Burned caliche	No	2



FB7252 (41EP1832).

FB7483 (41EP1037)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
39499	19	2840 ± 60	1289–935 B.C.	Late Archaic
53357	19	2930 ± 50		
39500	14	1620 ± 70	A.D. 250–596	Mesilla phase
39501	13	1530 ± 60	A.D. 390–640	Mesilla phase
39502	36	1610 ± 50	A.D. 261–560	Mesilla phase
39503	32	3090 ± 90	1597–1055 B.C.	Late Archaic
39504	16	6290 ±110	5480–4940 B.C.	Early Archaic
39505	6	2060 ± 80	357 B.C.– A.D. 80	Late Archaic
39506	12	3090 ± 90	1597–1055 B.C.	Late Archaic

39507	43	1650 ± 80	A.D. 177–580	Late Archaic/Mesilla phase
50088	38	1400 ± 50	A.D. 538–654	Mesilla phase
50089	38	1500 ± 50		
50090	43	2570 ± 50	796–448 B.C.	Late Archaic
50091	43	2730 ± 70		
53358	43	2470 ± 60		
53359	43	2450 ± 50		
53360	43	2480 ± 60		
53361	44	3280 ± 80	1682 ± 1410 B.C.	Late Archaic
53362	44	3170 ± 70		

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-91-453	188	162	1	2.55	El Paso phase/Mesilla phase
DL-91-454	168	231	1	6.20	Late Archaic
DL-91-461	171	152	1	7.21	Late Archaic
				5.31	Late Archaic
DL-91-464	170	156	1	4.21	Mesilla phase
DL-92-366	65	101	0	6.12	Late Archaic

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	A.D. 1150–1450	El Paso phase
Projectile point	A.D. 1150–1450	El Paso phase
Projectile point	A.D. 1150–1450	El Paso phase

Size (meters): 17,100

Erosion: Low — Modern Disturbance: Moderate

Surface Features:	32	Surface Artifacts:	128
Total Features:	42	Tested Features:	41

Feature Types:

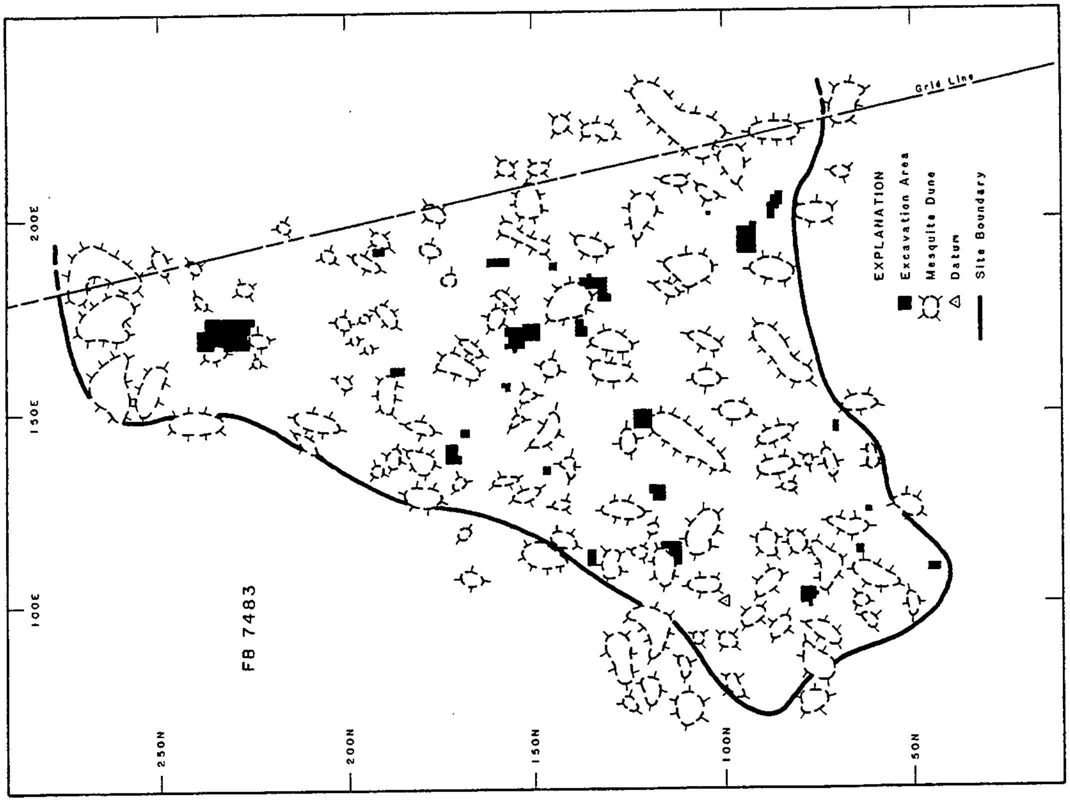
Burned Caliche	29
Burned caliche/fire-cracked rock	5
Small stain	8
Large stain	1

Square Meters Tested: 420 — Subsurface Artifacts: 412

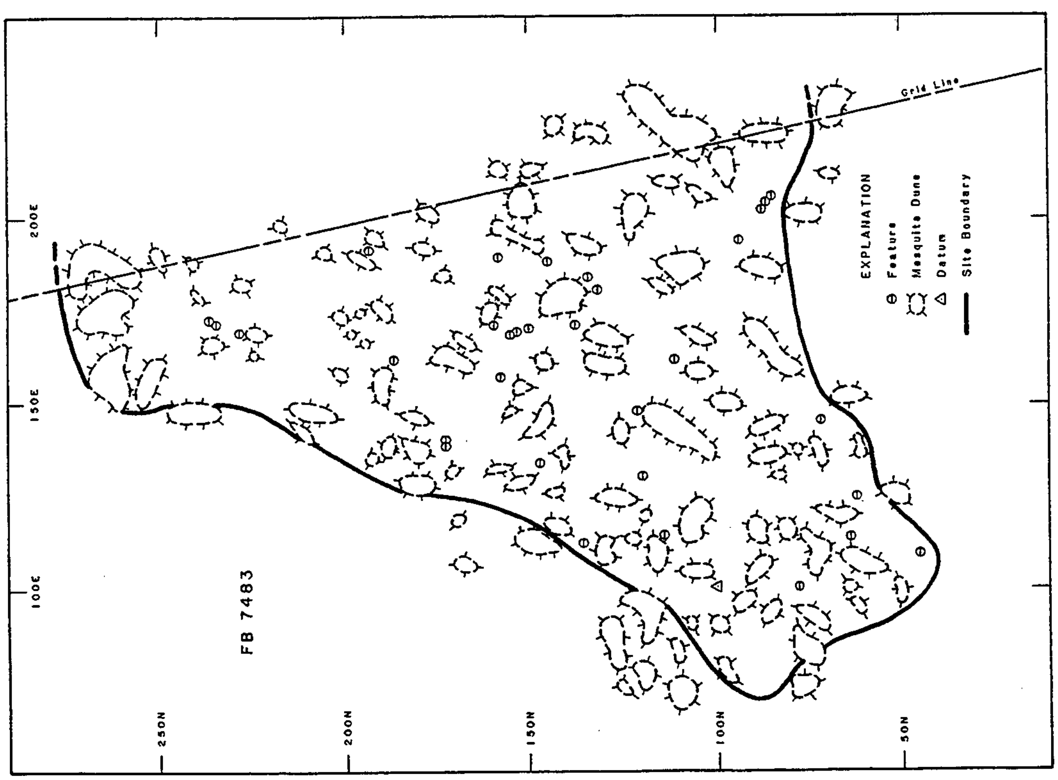
Unique artifacts: 1 unground red ocher recovered adjacent to Feature 16

FB7483 was extensively tested, with work on 41 of the 42 features on the site. A total of 21 block excavations tested 39 of the features. A single 1-by-1-square-meter unit excavation was done on the remaining feature. Another judgmentally placed 1-by-1 unit was excavated. Finally, a block excavation was placed but was not associated with a feature. Block excavations and the area of the site are:

103 square meters over Features 13, 14, 33, and 36, north edge
60 square meters over Feature 16, southeast area
19 square meter block over Features 4, 11, and 12, southeast area
45 square meters over Features 5, 9, 10, and 22, central area
29 square meters over Features 7 and 8, central area



FB7483 (41EP1037) Excavation Areas.



FB7483 (41EP1037) Features.

9 square meters over Feature 6, central area
5 square meters over Feature 23, central area.
28 square meters over Feature 3, 43, and 44, south-central area
17 square meters over Feature 1, south-central area
17 square meters over Feature 26, southwest area
16 square meters over Features 24 and 28, west-central area
14 square meters over Feature 2, west-central area
12 square meters over Feature 34, east-central area
8 square meters around Feature 20, extreme west edge
6 square meter over Feature 32, southern area
4 square meters over Feature 19, southern area
1-by-2-meter block over Feature 35, southern area
1-by-1-meter unit over Feature 27, southern area
6 square meters over Feature 15, northeast area
6 square meters over Feature 29, northern area
4 square meters over Feature 21, east-central area
4 square meters on top of Feature 25, west area

The only block that was not associated with a feature was a 4-square-meter area in the west-central portion of the site to investigate where a single slab metate was previously collected. A single judgmentally placed 1-by-1-meter unit was excavated against the east edge of the site northeast of the Feature 16 excavation.

Testing of this site suggests significant data remain. All block excavation areas recovered subsurface material. Block excavations uncovered eight features. The single test unit revealed subsurface material in built-up interdunal sands on the eastern edge of FB7483. Not all areas of built-up sands or dunes were tested.

Feature No.	East	North	Type	Tested	Condition
1	114	113	Burned caliche with stain	Yes	6
2	129	117	Burned caliche	Yes	3
4	201	88	Burned caliche with stain	Yes	7
5	170	155	Small stain <1 meter	Yes	6
6	171	137	Burned caliche	Yes	4
7	184	134	Burned caliche/fire-cracked rock/stain	Yes	4
8	180	132	Burned caliche	Yes	5
9	170	150	Burned caliche	Yes	5
10	170	153	Burned caliche with stain	Yes	5
11	204	87	Small stain <1 meter	Yes	6
12	205	85	Small stain <1 meter	Yes	6
13	169	232	Burned caliche	Yes	5
14	172	236	Burned caliche with stain	Yes	6
15	191	193	Burned caliche	Yes	4
16	194	95	Small stain <1 meter	Yes	6
17	167	159	Small stain <1 meter	Yes	5
19	114	64	Small stain <1 meter	Yes	5
20	112	135	Burned caliche	Yes	3
21	187	145	Burned caliche	No	3
23	157	157	Small stain <1 meter	Yes	5
24	140	172	Small stain <1 meter	Yes	6
25	134	147	Burned caliche	Yes	3
26	100	77	Burned caliche/fire-cracked rock	Yes	3
27	124	61	Small stain <1 meter	Yes	5
28	138	172	Small stain <1 meter	Yes	6

29	162	186	Small stain <1 meter	Yes	6
32	109	45	Small stain <1 meter	Yes	5
34	189	160	Burned caliche	Yes	4
35	146	68	Small stain <1 meter	Yes	5
36	172	237	Burned caliche with stain	Yes	5
40	163	112	Burned caliche	No	3
43	147	121	Small stain <1 meter	Yes	6

FB7484 (41EP1034)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-40	197	449	0	3.09	Mesilla phase/El Paso phase
DL-92-45	246	429	0	2.98	Mesilla phase/El Paso phase
DL-92-367	199	425	0	3.96	Mesilla phase
DL-92-368	200	427	0	3.02	Mesilla phase/El Paso phase
DL-92-369	200	420	0	6.13	Late Archaic
DL-92-370	201	418	0	5.11	Late Archaic/Mesilla phase
DL-92-371	206	418	0	3.02	Mesilla phase/El Paso phase
DL-92-372	205	419	0	6.72	Late Archaic
DL-92-373	281	333	0	5.59	Late Archaic
DL-92-374	341	316	0	5.91	Late Archaic
DL-92-375	404	351	0	2.14	El Paso phase/Protohistoric
DL-92-376	355	344	0	7.27	Late Archaic

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	4000–2000 B.C.	Middle Archaic
Projectile point	4000 B.C. – A.D. 250	Middle/Late Archaic
Projectile point	2000 B.C. – A.D. 1150	Late Archaic to Mesilla phase
El Paso Bichrome ceramic	A.D. 1150–1450	El Paso phase

Size (meters): 34,817

Erosion: Moderate — Modern Disturbance: Moderate

Surface Features: 33 — Surface Artifacts: 247

Total Features: 34 — Tested Features: 7

Feature Types:

Burned Caliche	21
Fire-cracked rock	2
Burned caliche/fire-cracked rock	5
Small stain	6

Square Meters Tested: 47 — Subsurface Artifacts: 19

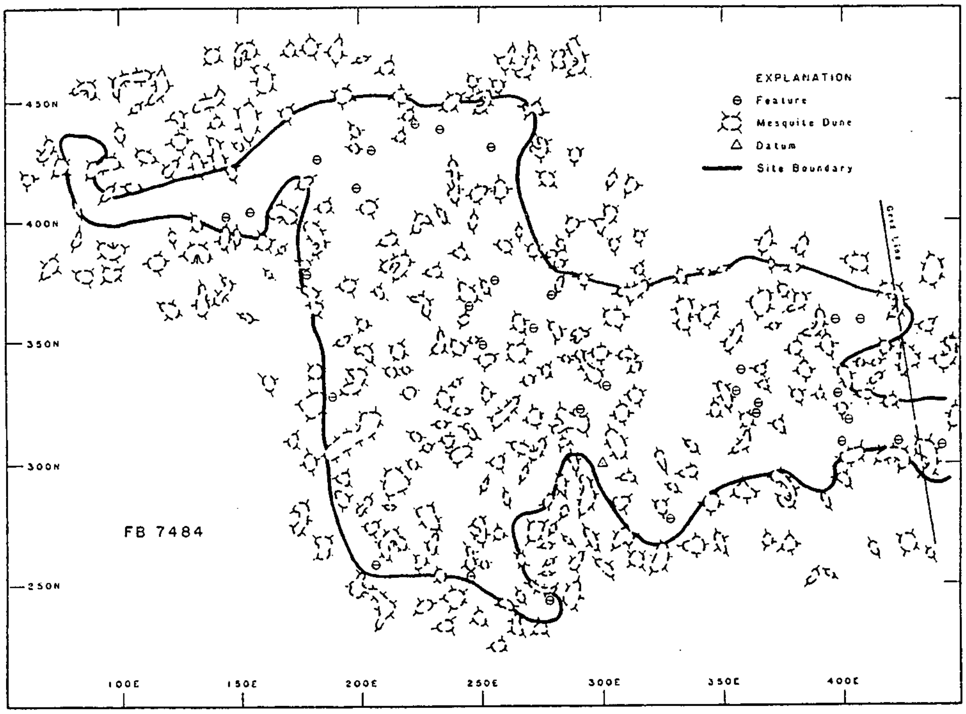
The site was tested in five block excavations and two 1-by-1-meter units. The 1-by-1 units were two of the 49 systematic units excavated in southernmost grid quad. The largest of the block excavations was a

17-square-meter area in the east-central portion of the site placed over Feature 24. A total of three 9-square-meter blocks was excavated on this site. One was placed just southwest of Feature 24 over Feature 23. Another was placed with Feature 25 in the east portion of the site. The last was located over Feature 30 in the northwest portion of the site. The last of the blocks was a 4-square-meter excavation over Feature 29 in the southwest area. The two 1-by-1-meter units were in the west and northwest portions of the site.

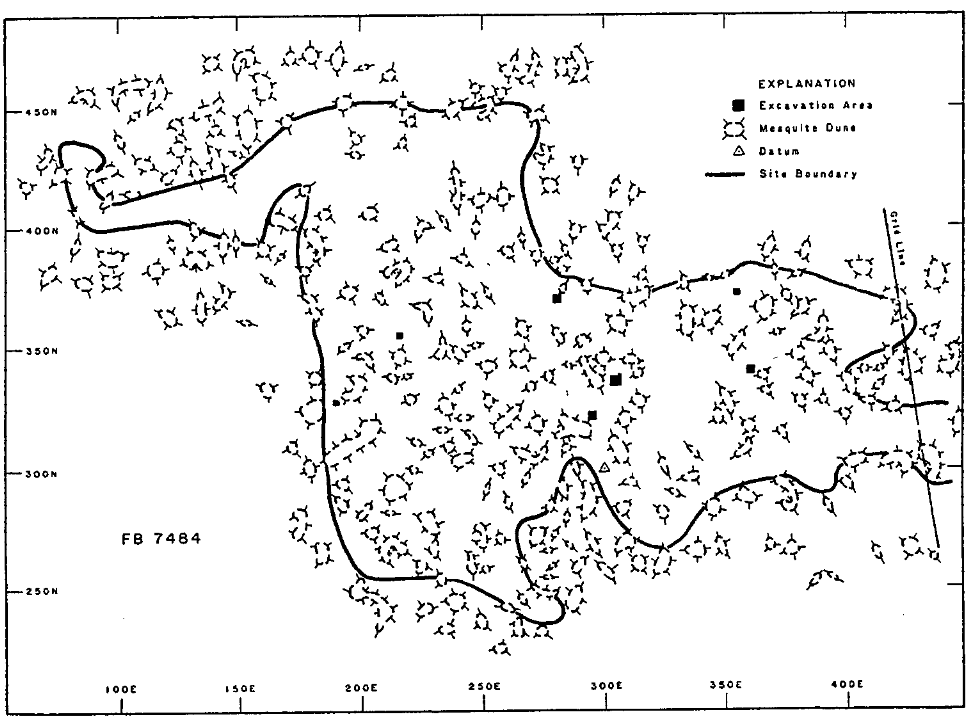
The site was revisited during Phase III and additional surface artifacts were noted, though not collected. This indicates that artifacts are being exposed, and block excavations uncovered subsurface artifacts.

None of the block excavations exhausted the extent of cultural evidence. Large areas of the site and the majority of the surface features have not been tested. The test excavations, untested features, and the continuing exposure of cultural materials indicate that significant data remain.

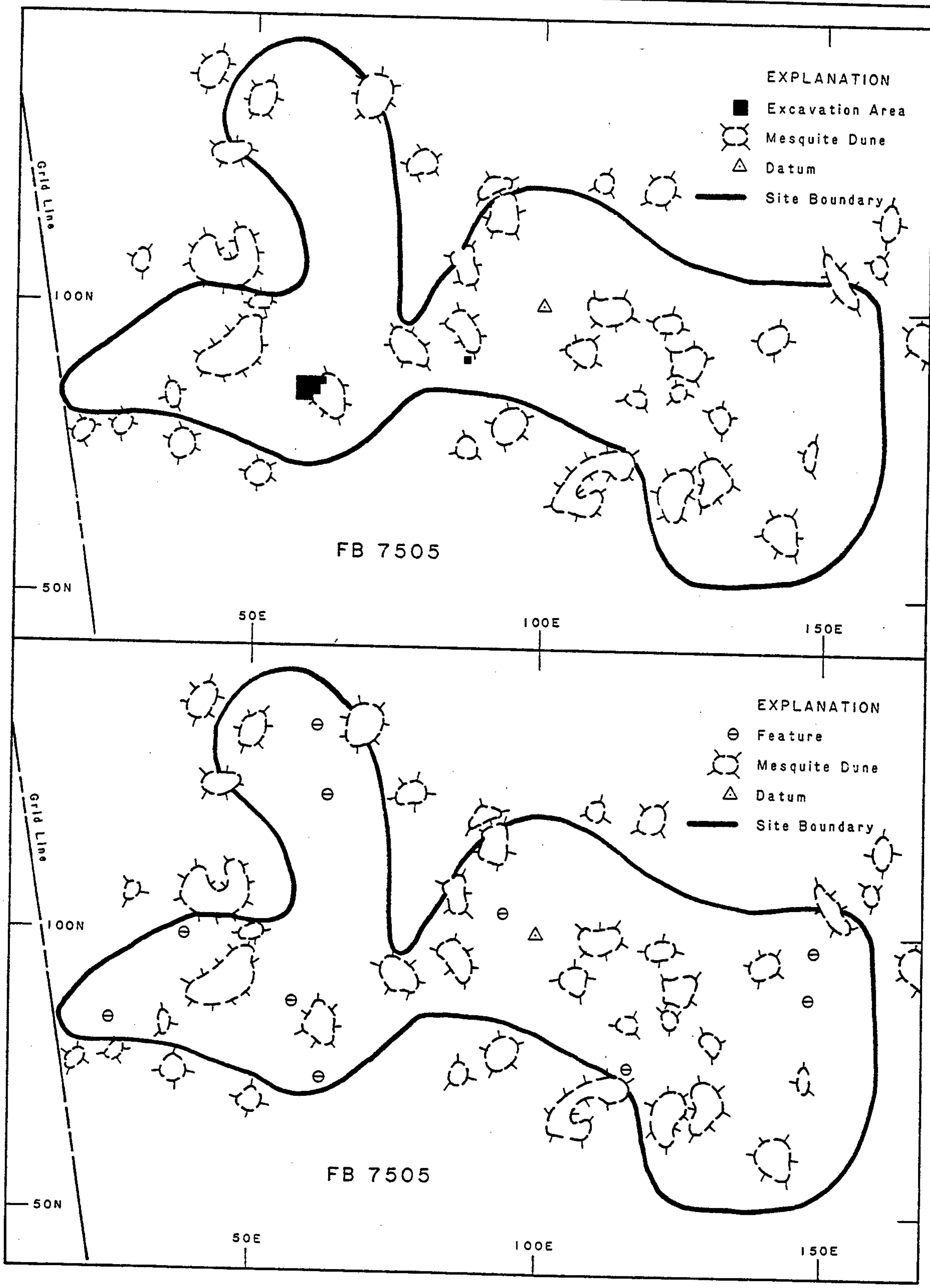
Feature No.	East	North	Type	Tested	Condition
1	397	359	Small stain <1 meter	No	4
2	407	359	Burned caliche	No	5
3	398	329	Burned caliche/fire-cracked rock	No	4
4	402	318	Burned caliche/fire-cracked rock	No	3
5	400	309	Burned caliche	No	2
6	422	309	Burned caliche with stain	No	3
7	441	308	Burned caliche	No	5
8	328	277	Burned caliche	No	3
9	206	257	Small stain <1 meter	No	6
10	178	378	Burned caliche	No	4
11	197	413	Burned caliche/fire-cracked rock	No	3
12	278	243	Burned caliche	No	6
13	181	426	Fire-cracked rock	No	5
14	272	356	Burned caliche	No	3
15	254	431	Burned caliche	No	5
16	232	438	Fire-cracked rock	No	5
17	221	440	Burned caliche	No	3
18	154	404	Burned caliche	No	3
19	204	430	Burned caliche	No	4
20	255	376	Burned caliche	No	5
21	245	365	Burned caliche/fire-cracked rock	No	4
22	250	349	Burned caliche	No	2
23	291	322	Burned caliche with stain	Yes	5
24	302	333	Burned caliche/fire-cracked rock	Yes	5
25	356	339	Burned caliche	Yes	5
26	355	330	Burned caliche	No	4
27	364	325	Burned caliche	No	4
28	363	321	Burned caliche	No	4
29	188	327	Small stain <1 meter	Yes	6
30	276	365	Small stain <1 meter	Yes	6
31	144	402	Small stain <1 meter	No	5
32	244	253	Burned caliche	No	4
33	293	320	Burned caliche with stain	Yes	4



FB7484 (41EP1034) Features.



FB7484 (41EP1034) Excavation Areas.



FB7505 (41EP985). *Top:* excavation area; *bottom:* features.

FB7505 (41EP985)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1150	Formative period

Size (meters): 4,735

Erosion: Moderate — Modern Disturbance: Low

Surface Features:	10	Surface Artifacts:	29
Total Features:	10	Tested Features:	1

Feature Types:

Burned Caliche	6
Fire-cracked rock	1
Burned caliche/fire-cracked rock	3

Square Meters Tested: 17 — Subsurface Artifacts: 11

Historic Artifacts: 9 bottle fragments (A.D. 1880–1900)

Site testing consisted of a single 1-by-1-square-meter excavation unit and a single block excavation. The 1-by-1 unit was one of the 49 systematically placed units within the southernmost grid quad. This unit fell in the central portion of the site. The block excavation was a 16-square-meter area in the southwest-central portion of the site over Feature 6.

The site was revisited during Phase III of the project. Additional surface artifacts were collected expanding the site boundary and indicating artifacts are being exposed. The block excavation uncovered subsurface cultural materials and did not exhaust the subsurface horizontal extent of cultural evidence.

The collection of additional artifacts from the surface and the discovery of subsurface cultural materials from the block excavation indicate that the site still contains significant data. The majority of surface features, along with large areas of the site, have not been tested.

Feature No.	East	North	Type	Tested	Condition
1	116	77	Burned caliche	No	5
2	150	98	Burned caliche	No	5
3	94	103	Burned caliche	No	5
4	149	89	Burned caliche	No	5
5	63	74	Burned caliche/fire-cracked rock	No	5
6	57	88	Burned caliche/fire-cracked rock	Yes	5
7	25	84	Burned caliche	No	5
8	39	99	Burned caliche/fire-cracked rock	No	5
9	63	124	Burned caliche	No	5
10	62	136	Fire-cracked rock	No	5

FB7508 (41EP982)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43194	7	3780 ± 60	2470–2033 B.C.	Middle Archaic

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-46	353	210	0	5.14	Late Archaic/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Unspecified brownware	A.D. 250–1450	Formative period

Size (meters): 40,502

Erosion: Low — Modern Disturbance: Low

Surface Features: 28 — Surface Artifacts: 77

Total Features: 28 — Tested Features: 3

Feature Types:

Burned Caliche	21
Fire-cracked rock	1
Burned caliche/fire-cracked rock	4
Small stain	2

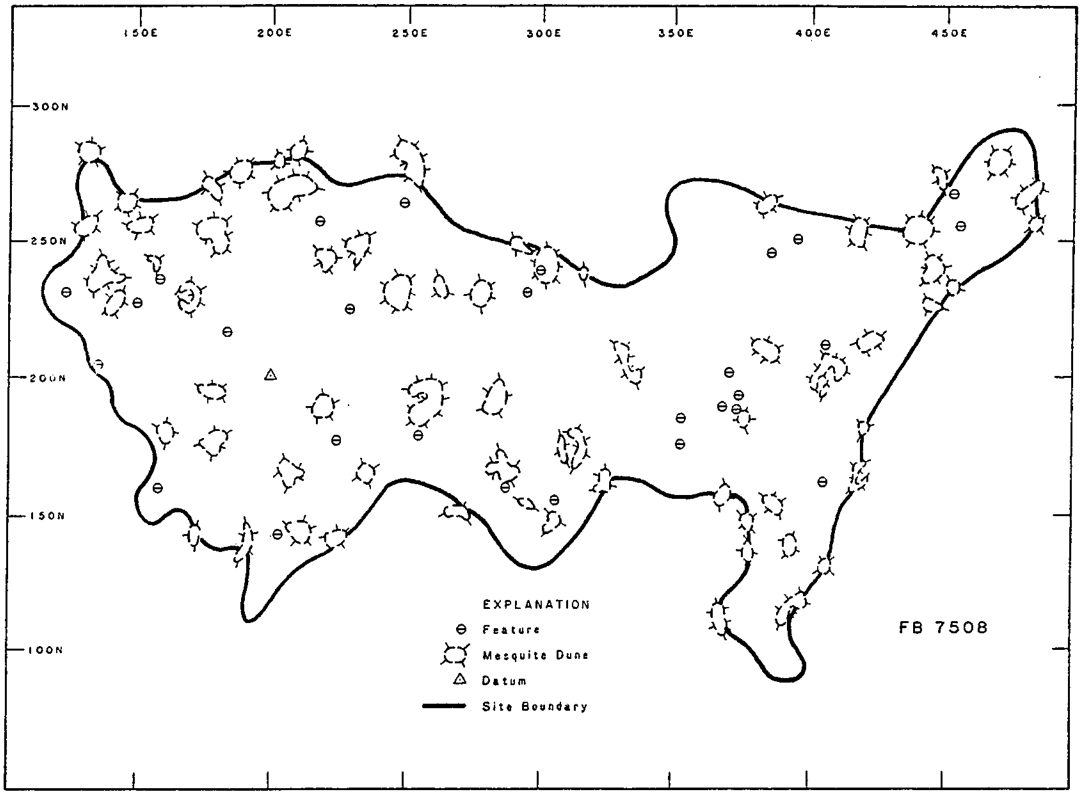
Square Meters Tested: 22 — Subsurface Artifacts: 4

The site was tested in three block excavations and three 1-by-1-meter units that were part of the 49 systematic test units excavated in southernmost grid quad. The block excavations tested three of the surface features.

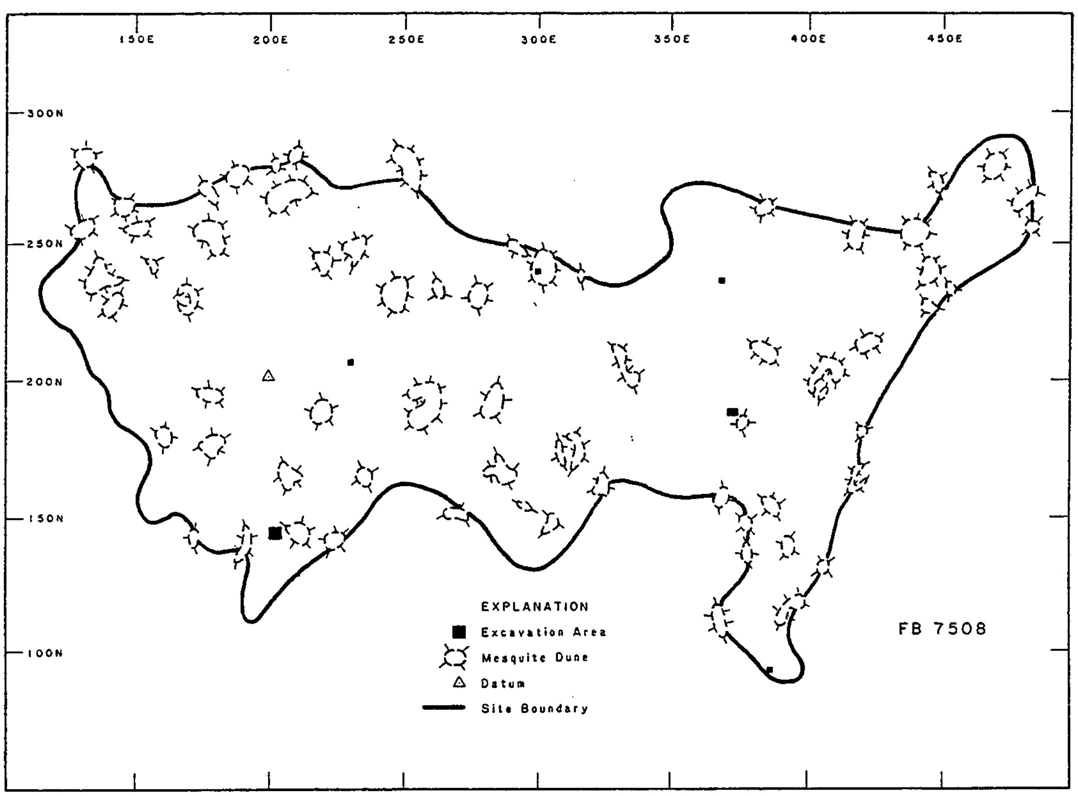
The largest of the block excavations was a 9-square-meter area in the southwest portion of the site over Feature 7. A 6-square-meter block was located over Feature 22 in the east portion of the site. A 4-square meter block was placed over Feature 14 in the north-central portion of the site. The three 1-by-1-meter-square units were in the west-central, southeast corner, and northeast central portions of the site.

Testing 22 square meters of this site revealed subsurface cultural materials and did not exhaust the subsurface potential. This factor in combination with the low degree of surface deflation, untested surface features, and low amount of testing indicates that significant data still remain on FB7508.

Feature No.	East	North	Type	Tested	Condition
1	124	232	Burned caliche	No	3
2	135	204	Burned caliche/fire-cracked rock	No	7
3	150	228	Burned caliche	No	5
4	158	237	Burned caliche/fire-cracked rock	No	5
6	157	157	Burned caliche	No	5
7	203	141	Small stain <1 meter	Yes	7
8	224	176	Burned caliche	No	7
10	229	226	Small stain <1 meter	No	5
11	183	217	Fire-cracked rock	No	7



FB7508 (41EP982) Features.



FB7508 (41EP982) Excavation Areas.

12	249	265	Burned caliche	No	3
13	295	232	Burned caliche	No	5
14	301	240	Burned caliche	Yes	7
16	255	177	Burned caliche	No	5
17	289	164	Burned caliche	No	5
18	353	175	Burned caliche	No	5
19	353	184	Burned caliche	No	5
20	369	189	Burned caliche	No	7
21	374	193	Burned caliche	No	7
22	374	187	Burned caliche	Yes	7
23	371	201	Burned caliche	No	5
24	385	247	Burned caliche	No	3
25	395	251	Burned caliche	No	3
26	453	268	Burned caliche/fire-cracked rock	No	3
27	455	257	Burned caliche	No	3
28	406	212	Burned caliche	No	3
29	405	161	Burned caliche	No	5
30	306	154	Burned caliche/fire-cracked rock	No	3
31	217	258	Burned caliche	No	5

FB7510 (41EP978)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43197	68	1910 ± 60	90 B.C.–A.D. 230	Late Archaic
47931	38	1530 ± 50	A.D. 535–650	Mesilla phase
47932	38	1390 ± 50		
47933	40	1600 ± 50	A.D. 408–598	Mesilla phase
47934	40	1500 ± 60		
47935	74	1500 ± 60	A.D. 430–644	Mesilla phase
47936	74	1480 ± 60		
53363	39	2250 ± 60	410–132 B.C.	Late Archaic

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-1	322	243	0	3.16	Mesilla phase/El Paso phase
DL-92-2	374	233	0	2.65	El Paso phase/Mesilla phase
DL-92-3	310	267	0	3.28	Mesilla phase
DL-92-5	266	239	0	3.99	Mesilla phase
DL-92-6	313	267	0	8.60	Late Archaic
DL-92-7	311	265	0	6.24	Late Archaic
				2.38	El Paso phase/Mesilla phase
DL-92-8	358	156	0	1.97	El Paso phase
DL-92-9	373	241	0	2.60	El Paso phase/Mesilla phase
DL-92-10	393	245	0	4.07	Mesilla phase
				3.02	Mesilla phase/El Paso phase
DL-92-377	320	280	0	–	–
DL-92-378	321	276	0	4.94	Mesilla phase/Late Archaic
DL-92-379	313	266	0	2.90	Mesilla phase/El Paso phase

				3.60	Mesilla phase
DL-92-380	312	265	0	3.65	Mesilla phase
DL-92-381	294	268	0	3.54	Mesilla phase
DL-92-382	299	244	0	2.97	Mesilla phase/El Paso phase
DL-92-383	296	244	0	2.97	Mesilla phase/El Paso phase
DL-92-384	310	264	0	10.43	Middle Archaic
DL-92-385	312	262	0	3.89	Mesilla phase
DL-92-386	325	252	0	3.74	Mesilla phase
DL-92-387	375	203	0	3.84	Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	10,000–6000 B.C.	Paleoindian period
Projectile point	10,000–6000 B.C.	Paleoindian period
Projectile point	2000 B.C. – A.D. 1150	Late Archaic to Mesilla phase
Projectile point	2000 B.C. – A.D. 1150	Late Archaic to Mesilla phase
El Paso Polychrome ceramic	A.D.1150–1450	El Paso phase

Size (meters): 106,401

Erosion: Moderate Modern Disturbance: Low

Surface Features:	72	Surface Artifacts:	662
Total Features:	75	Tested Features:	12

Feature Types:

Burned Caliche:	36
Fire-cracked rock	5
Burned caliche/fire-cracked rock	21
Small stain	13
Other	1

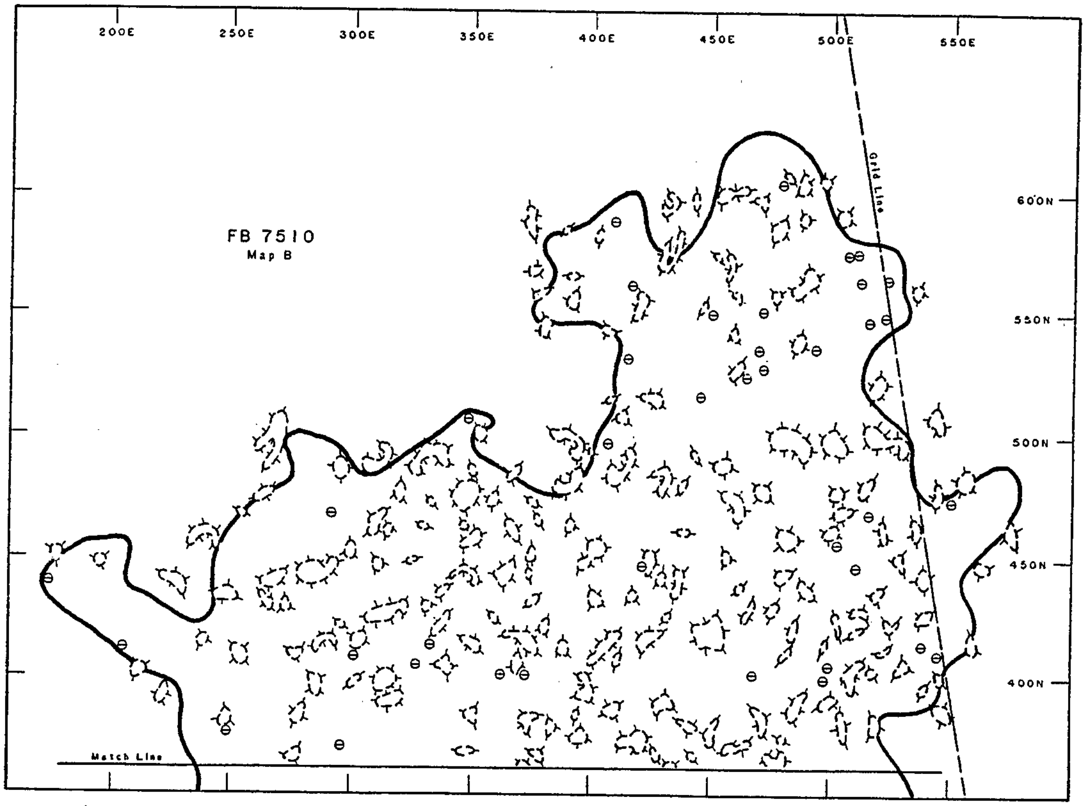
Square Meters Tested: 80 Subsurface Artifacts: 54

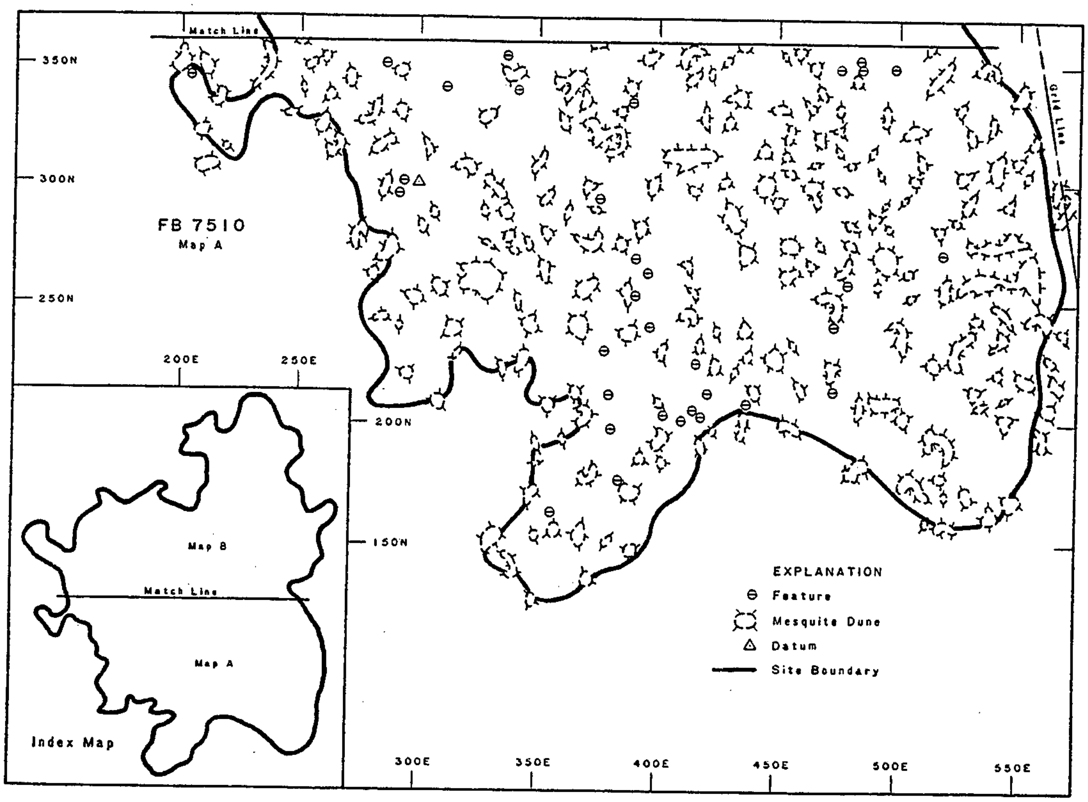
The site was tested in six block excavations and seven 1-by-1-meter units. The 1-by-1 units were seven of the 49 systematically excavated test units within the southernmost grid quad. The block excavations, which tested seven features identified on the surface, and area of the site are:

31 square meters over Features 38 and 40, northeast area
10 square meters over Feature 18, southern area
9 square meters over Feature 45, north-central area
8 square meters over Feature 23, southwest area
8 square meters over Feature 52, east-central area
6 square meters over Feature 68, extreme north area

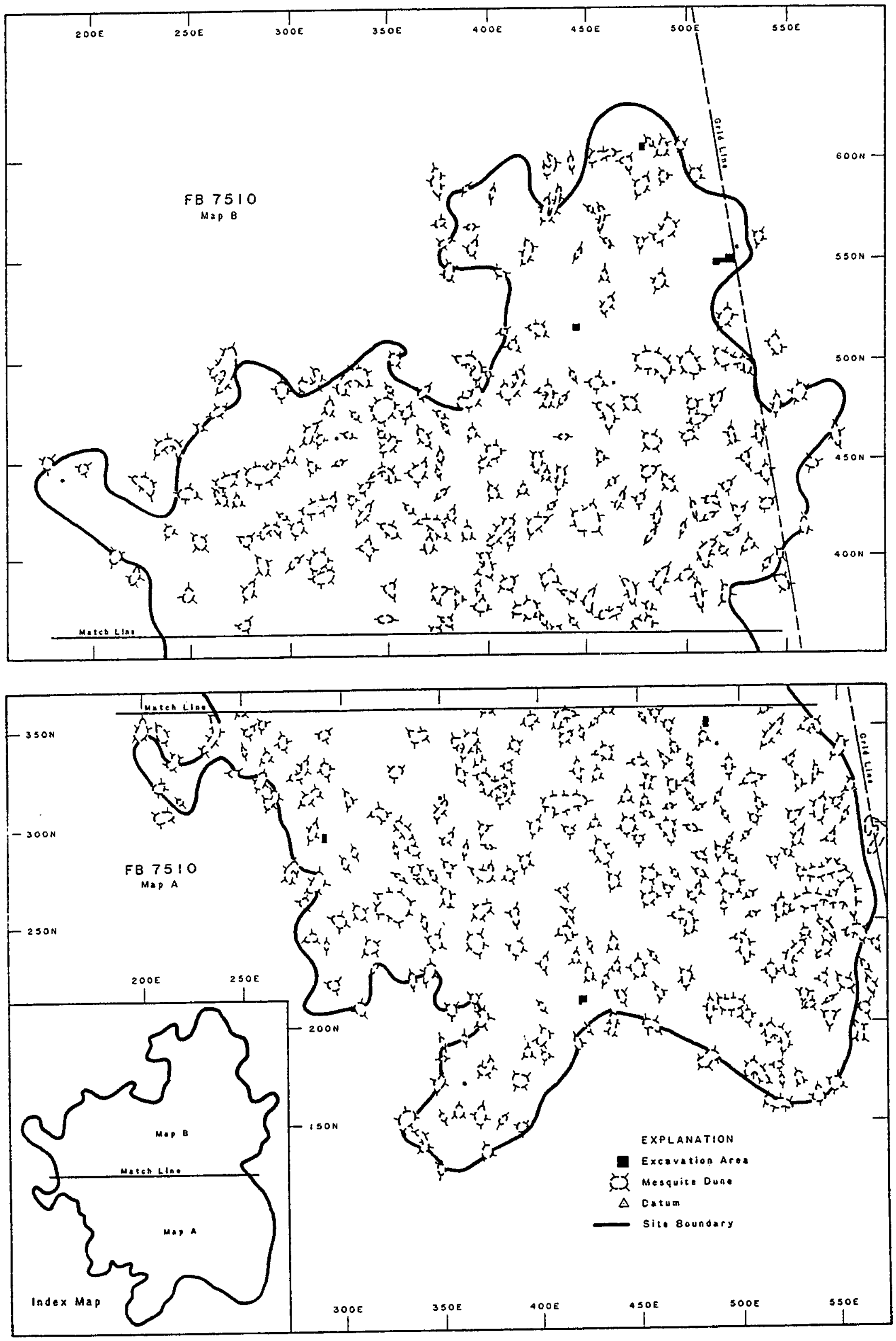
The seven 1-by-1-meter units extended across the south edge, through the central portion, and across the northern portions of the site.

Project personnel who revisited the site during Phase III of the project to conduct additional testing noted but did not collect additional surface artifacts. The presence of these materials indicate that cultural materials are being exposed. Excavations within both block areas and the 1-by-1-meter units uncovered three subsurface features, and cultural materials were collected from most of these excavations. None exhausted the horizontal extent of subsurface material.





FB7510 (41EP978) Features.



FB7510 (41EP978) Excavation Areas.

The testing, the continual exposure of cultural materials out of buried soils, the number of features and areas that remain untested, and the moderate amount of surface deflation all indicate significant data still remain on the site.

Feature No.	East	North	Type	Tested	Condition
1	174	438	Burned caliche	No	4
2	206	410	Burned caliche with stain	No	6
3	250	375	Burned caliche	No	5
4	204	345	Burned caliche	No	4
5	379	230	Burned caliche	No	6
6	392	269	Burned caliche	No	3
7	400	262	Burned caliche	No	4
8	391	253	Burned caliche	No	5
9	398	240	Burned caliche/fire-cracked rock	No	4
10	381	211	Burned caliche	No	5
11	383	197	Burned caliche/fire-cracked rock	No	3
12	358	163	Other	No	7
13	386	176	Small stain <1 meter	No	6
14	412	201	Burned caliche	No	4
15	417	206	Burned caliche/fire-cracked rock	No	4
16	420	202	Burned caliche/fire-cracked rock	No	5
17	404	203	Burned caliche/fire-cracked rock	No	4
18	425	211	Burned caliche with stain	Yes	6
19	418	221	Burned caliche	No	7
20	439	208	Burned caliche	No	3
21	475	214	Burned caliche/fire-cracked rock	No	4
22	376	293	Burned caliche/fire-cracked rock	No	3
23	294	295	Small stain <1 meter	Yes	6
24	294	300	Burned caliche/fire-cracked rock	No	5
25	311	340	Burned caliche with stain	No	6
26	286	351	Burned caliche	No	3
27	292	467	Burned caliche	No	4
28	348	505	Burned caliche	No	3
29	407	496	Fire-cracked rock	No	5
30	415	531	Burned caliche/fire-cracked rock	No	5
31	465	524	Burned caliche	No	6
32	470	535	Burned caliche	No	5
33	471	527	Burned caliche/fire-cracked rock	No	5
34	494	536	Burned caliche/fire-cracked rock	No	4
35	511	562	Burned caliche/fire-cracked rock	No	4
36	471	551	Burned caliche	No	6
37	450	550	Burned caliche	No	4
38	510	552	Burned caliche with stain	Yes	5
39	522	565	Burned caliche with stain	Yes	6
40	522	549	Small stain <1 meter	Yes	6
41	507	575	Small stain <1 meter	No	6
42	510	575	Small stain <1 meter	No	6
43	416	561	Burned caliche	No	4
44	409	587	Burned caliche/fire-cracked rock	No	5
45	444	521	Small stain <1 meter	Yes	6
46	514	467	Burned caliche/fire-cracked rock	No	3
47	504	456	Burned caliche/fire-cracked rock	No	5

48	511	447	Burned caliche/fire-cracked rock	No	3
49	546	409	Burned caliche with stain	No	5
50	540	413	Small stain <1 meter	No	4
51	498	350	Burned caliche	No	5
52	484	355	Burned caliche/fire-cracked rock/stain	Yes	6
53	475	349	Burned caliche/fire-cracked rock	No	3
54	519	271	Burned caliche/fire-cracked rock	No	3
55	474	240	Burned caliche	No	4
56	480	259	Burned caliche	No	5
57	501	405	Small stain <1 meter	No	5
58	469	401	Burned caliche	No	3
59	389	334	Burned caliche	No	5
60	341	340	Fire-cracked rock	No	6
61	364	400	Burned caliche/fire-cracked rock	No	5
62	334	412	Burned caliche	No	6
63	302	407	Burned caliche	No	6
64	336	355	Burned caliche/fire-cracked rock	No	3
65	297	369	Burned caliche	No	4
66	422	446	Small stain <1 meter	No	6
67	499	399	Small stain <1 meter	No	6
68	474	604	Small stain <1 meter	Yes	6
69	558	474	Burned caliche/fire-cracked rock	No	4
70	483	351	Fire-cracked rock with stain	Yes	3
73	374	400	Small stain <1 meter	No	5
75	327	404	Burned caliche with stain	No	4

FB7517 (41EP972)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43198	45	2430 ± 50	787–400 B.C.	Late Archaic

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-44	237	198	0	4.96	Late Archaic/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	4000–2000 B.C.	Middle Archaic
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 43,047

Erosion: Severe

Modern Disturbance: Moderate

Surface Features: 48

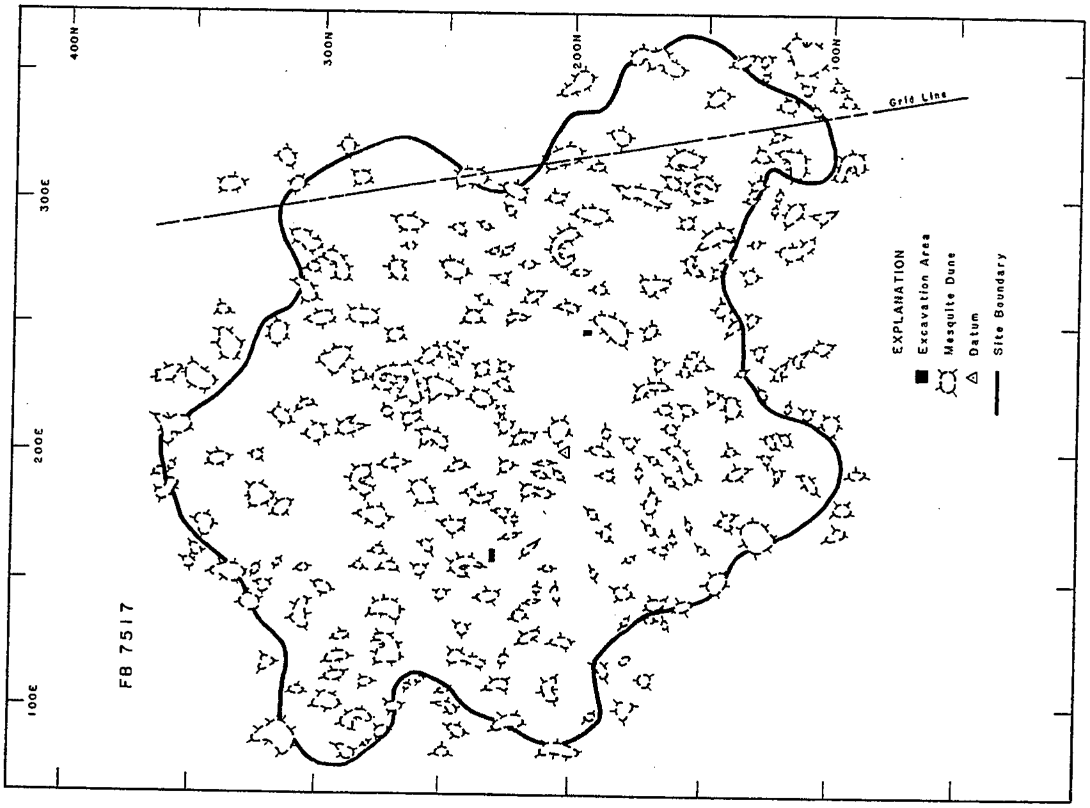
Total Features: 49

Surface Artifacts: 202

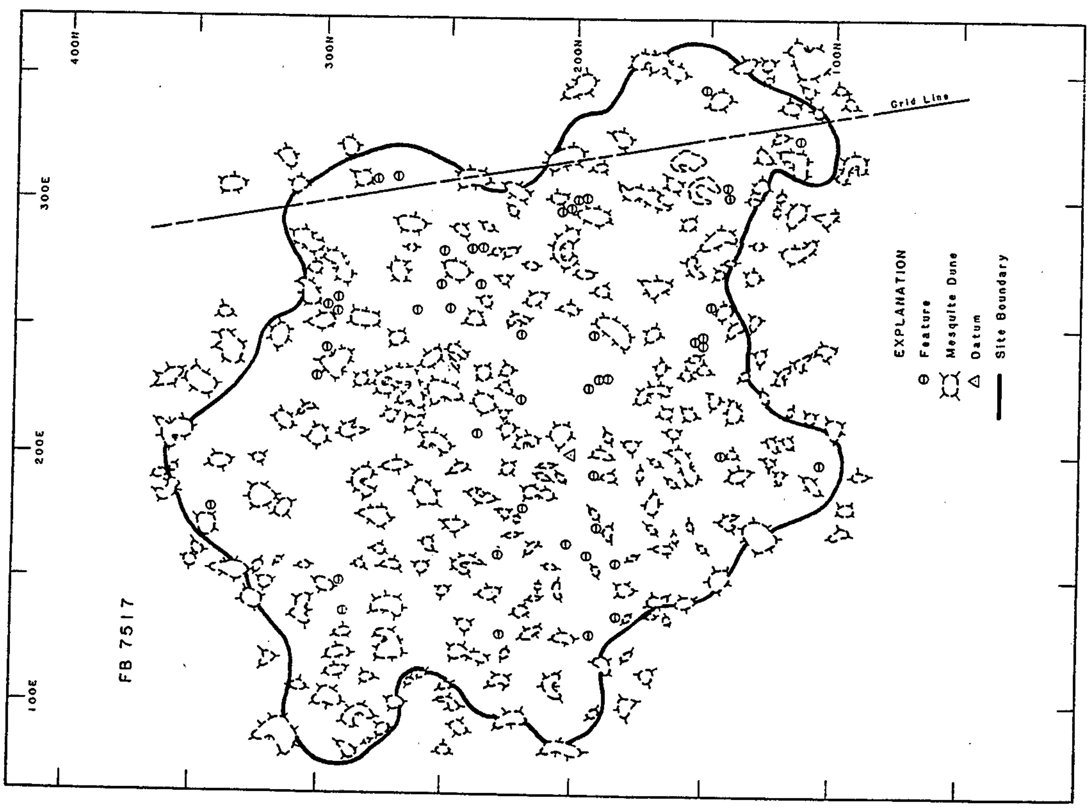
Tested Features: 6

Feature Types:

Burned Caliche	17
Fire-cracked rock	1



FB7517 (41EP972) Excavation Areas.



FB7517 (41EP972) Features.

Burned caliche/fire-cracked rock	14
Small stain	17

Square Meters Tested: 22 Subsurface Artifacts: 5

Five of the surface features were tested in three block excavations. One excavation consisted of an 8-square-meter area in the southern portion of the site over Feature 27, 28, and 29. Another 8-square-meter block was excavated in the west-central portion over Feature 39. Finally, 6 square meters were excavated over Feature 45 in the central portion of the site.

Block excavations uncovered one additional feature, and subsurface cultural materials were found in all tested areas. None of the excavations exhausted the subsurface evidence. The results of the testing conducted, the high number of untested surface features, and the low degree of testing indicate that significant data still remain on the site.

Feature No.	East	North	Type	Tested	Condition
1	200	141	Burned caliche/fire-cracked rock	No	4
2	196	104	Burned caliche/fire-cracked rock	No	3
3	135	181	Burned caliche	No	3
4	156	182	Burned caliche	No	5
5	160	193	Burned caliche/fire-cracked rock	No	4
6	165	201	Burned caliche/fire-cracked rock	No	5
7	128	192	Burned caliche	No	6
8	178	324	Burned caliche	No	4
9	230	301	Burned caliche/fire-cracked rock	No	4
10	255	294	Burned caliche/fire-cracked rock	No	4
11	260	293	Burned caliche	No	3
12	257	297	Burned caliche	No	3
13	306	284	Burned caliche	No	3
14	307	270	Fire-cracked rock	No	3
15	279	240	Small stain <1 meter	No	5
16	279	236	Small stain <1 meter	No	5
17	278	250	Small stain <1 meter	No	5
18	294	205	Small stain <1 meter	No	5
19	295	202	Small stain <1 meter	No	5
20	299	199	Small stain <1 meter	No	5
21	299	196	Small stain <1 meter	No	5
22	342	149	Burned caliche	No	4
23	321	112	Burned caliche	No	3
24	303	140	Burned caliche/fire-cracked rock	No	4
25	300	139	Burned caliche	No	4
26	257	146	Burned caliche	No	3
27	245	150	Small stain <1 meter	Yes	4
28	243	150	Small stain <1 meter	Yes	4
29	244	152	Small stain <1 meter	Yes	4
30	192	191	Burned caliche/fire-cracked rock	No	4
31	178	218	Burned caliche/fire-cracked rock	No	3
32	208	236	Small stain <1 meter	No	3
33	222	220	Burned caliche	No	4
34	246	219	Burned caliche/fire-cracked rock	No	5
35	265	250	Burned caliche/fire-cracked rock	No	3
36	255	261	Small stain <1 meter	No	4

37	149	291	Burned caliche	No	3
38	137	289	Small stain <1 meter	No	3
39	159	229	Burned caliche	Yes	6
40	128	226	Burned caliche	No	2
41	230	186	Burned caliche	No	5
42	230	190	Burned caliche/fire-cracked rock	No	4
43	226	194	Burned caliche/fire-cracked rock	No	4
44	265	236	Burned caliche	No	3
45	245	191	Small stain <1 meter	Yes	6
46	171	189	Burned caliche	No	4
47	241	297	Small stain <1 meter	No	4
48	256	248	Small stain <1 meter	No	4

FB7520 (41EP970)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
50092	2	5620 ± 80	4712–4330 B.C.	Early Archaic

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-11	333	416	0	3.40	Mesilla phase
DL-92-12	124	353	0	7.15	Late Archaic
DL-92-13	164	372	0	3.00	Mesilla phase/El Paso phase
				2.20	El Paso phase/Protohistoric
DL-92-14	283	240	0	2.58	El Paso phase/Mesilla phase
				1.65	Protohistoric/El Paso phase
DL-92-388	118	356	0	6.78	Late Archaic
DL-92-389	78	423	0	2.51	El Paso phase/Mesilla phase
DL-92-390	151	425	0	2.60	El Paso phase/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	10,000–6000 B.C.	Paleoindian period
Projectile point	4000–2000 B.C.	Middle Archaic
Projectile point	4000–2000 B.C.	Middle Archaic
Undifferentiated brownware	A.D. 250–1450	Formative period
Projectile point	A.D. 1150–1450	El Paso phase

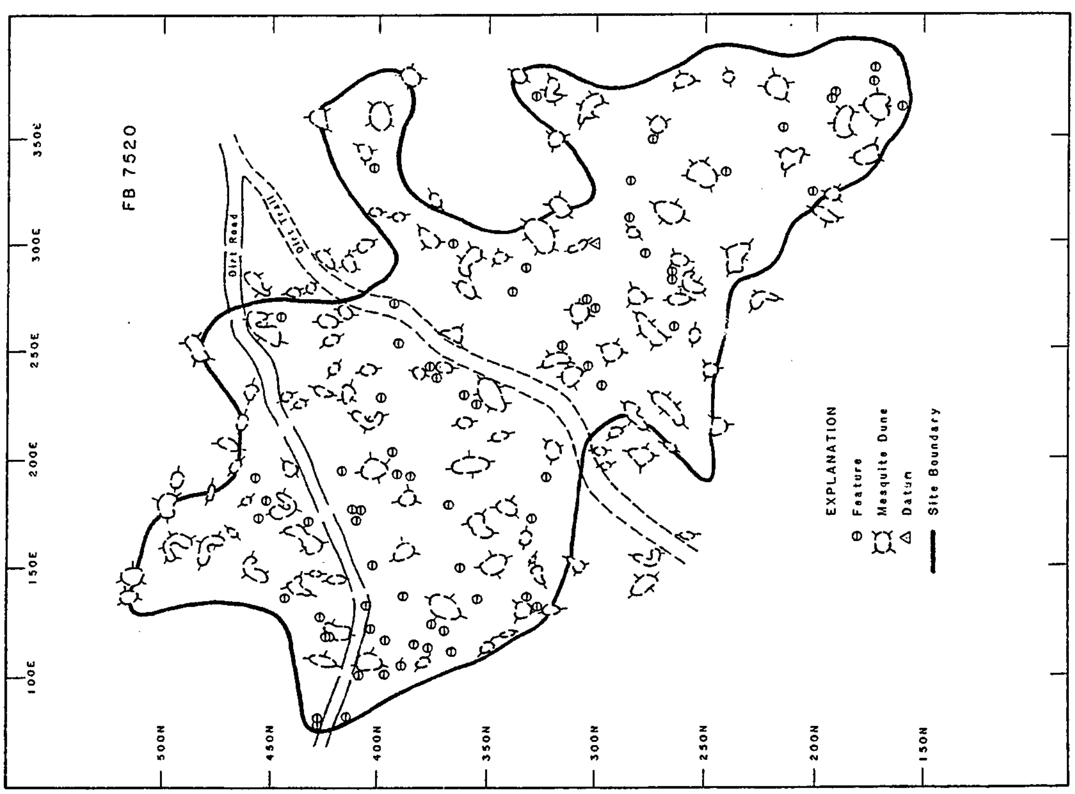
Size (meters): 57,551

Erosion: Moderate — Modern Disturbance: Moderate

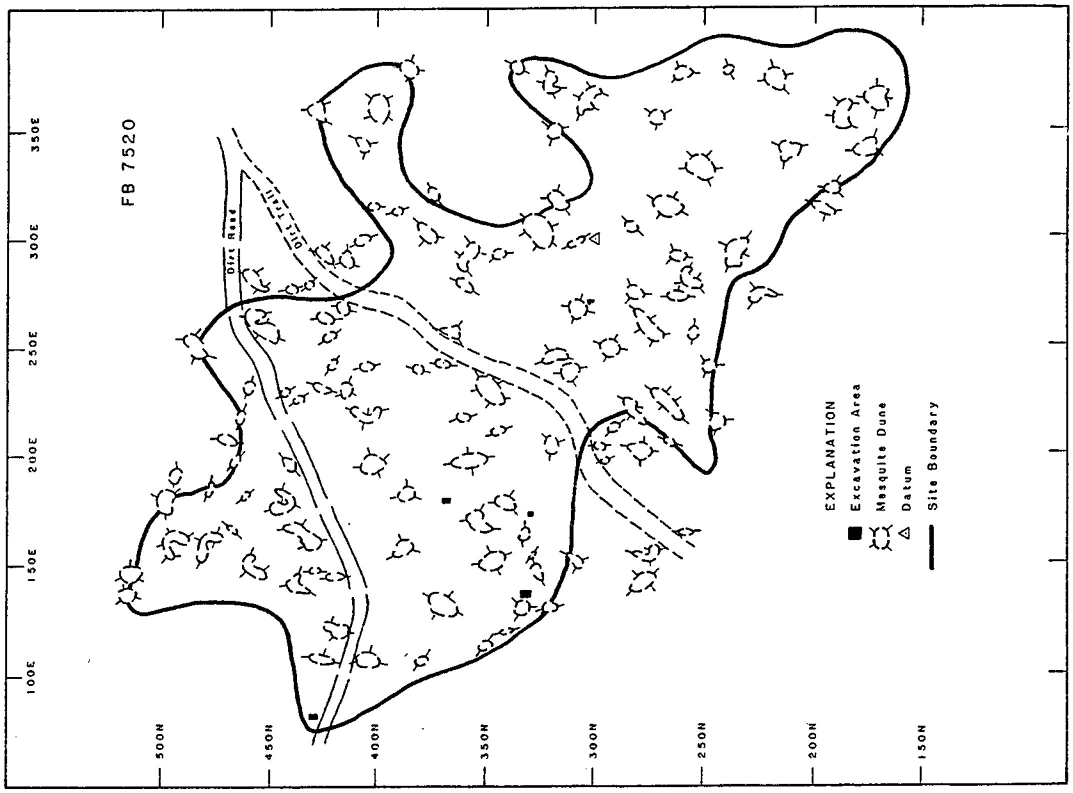
Surface Features:	70	Surface Artifacts:	463
Total Features:	70	Tested Features:	5

Feature Types:

Burned Caliche	33
Fire-cracked rock	1
Burned caliche/fire-cracked rock	25



FB7520 (41EP970) Features.



FB7520 (41EP970) Excavation Areas.

Small stain	10
Large stain	1

Square Meters Tested: 34 Subsurface Artifacts: 24
Unique artifacts: 1 piece of unground red ocher with Feature 27

Five surface features on the site were tested with block excavations; the largest consisted of 12 square meters in the southeast portion of the site over Feature 27. A 7-square-meter block was placed in the northwest corner of the site over Feature 2. A 6-square-meter block was placed over Feature 29 in the northwest-central portion of the site. A 5-square-meter block was dug in the central portion of the site over Feature 43. Finally, 4 square meters were excavated in the southwest portion of the site over Feature 67.

The site was revisited during Phase III to excavate what remained of Feature 2 for additional charcoal for a radiocarbon date. A few additional surface artifacts collected in this area of the site indicated cultural materials were being exposed. Test block excavations uncovered no additional features.

The majority of the surface features and certain areas of the site were not tested. Cultural materials are being exposed, and the site is only moderately eroded. Significant data remain on the site.

Feature No.	East	North	Type	Tested	Condition
1	78	427	Burned caliche	No	4
2	80	428	Small stain <1 meter	Yes	6
3	81	414	Burned caliche	No	5
4	100	408	Burned caliche	No	3
5	101	396	Burned caliche	No	3
6	105	389	Burned caliche/fire-cracked rock	No	4
7	116	398	Burned caliche/fire-cracked rock	No	4
8	122	404	Burned caliche/fire-cracked rock	No	5
9	118	424	Burned caliche	No	6
10	127	426	Burned caliche	No	6
11	136	443	Burned caliche	No	6
12	173	455	Burned caliche	No	5
13	181	451	Burned caliche/fire-cracked rock	No	4
14	192	456	Burned caliche	No	4
15	195	416	Burned caliche	No	5
16	172	432	Burned caliche	No	4
17	151	402	Burned caliche/fire-cracked rock	No	3
18	134	405	Burned caliche/fire-cracked rock	No	3
19	137	389	Burned caliche/fire-cracked rock/stain	No	3
20	124	375	Burned caliche with stain	No	4
21	114	384	Small stain <1 meter	No	4
22	113	377	Small stain <1 meter	No	4
23	111	366	Fire-cracked rock	No	5
24	120	370	Burned caliche	No	4
25	135	355	Burned caliche/fire-cracked rock	No	3
26	150	362	Burned caliche/fire-cracked rock	No	3
27	136	332	Burned caliche/fire-cracked rock	Yes	6
28	131	328	Burned caliche	No	5
29	179	367	Burned caliche	Yes	4
30	193	385	Burned caliche	No	6
31	204	393	Burned caliche/fire-cracked rock	No	3
32	254	391	Burned caliche/fire-cracked rock	No	4
33	177	409	Burned caliche/fire-cracked rock	No	5

34	177	411	Burned caliche/fire-cracked rock	No	4
35	172	410	Burned caliche/fire-cracked rock	No	4
36	238	373	Burned caliche	No	5
37	242	377	Burned caliche	No	4
38	273	393	Burned caliche	No	4
39	300	376	Burned caliche/fire-cracked rock	No	4
40	289	333	Burned caliche/fire-cracked rock	No	4
41	278	338	Small stain <1 meter	No	5
42	274	305	Burned caliche/fire-cracked rock	No	5
43	270	302	Small stain <1 meter	Yes	6
44	330	283	Burned caliche	No	5
45	312	284	Burned caliche/fire-cracked rock	No	5
46	371	228	Burned caliche/fire-cracked rock	No	5
47	349	274	Burned caliche	No	5
48	333	241	Burned caliche	No	4
49	353	215	Burned caliche	No	6
50	368	191	Burned caliche	No	3
51	376	172	Burned caliche/fire-cracked rock	No	4
52	382	172	Burned caliche/fire-cracked rock	No	4
53	363	159	Burned caliche with stain	No	2
54	323	201	Burned caliche/fire-cracked rock	No	3
55	286	265	Large stain >1 meter	No	5
56	283	264	Small stain <1 meter	No	5
57	295	277	Burned caliche	No	5
58	254	317	Burned caliche	No	3
59	234	297	Burned caliche	No	3
60	194	321	Small stain <1 meter	No	4
61	226	355	Burned caliche/fire-cracked rock	No	4
62	231	360	Burned caliche/fire-cracked rock	No	4
63	194	391	Burned caliche	No	5
64	243	304	Burned caliche	No	4
65	336	403	Small stain <1 meter	No	4
66	265	445	Burned caliche	No	3
67	173	329	Small stain <1 meter	Yes	6
68	229	399	Burned caliche with stain	No	5
69	261	264	Burned caliche	No	3
70	370	190	Small stain <1 meter	No	5

FB7547 (41EP964)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43199	3	2440 ± 60	790–390 B.C.	Late Archaic
43200	86	2210 ± 70	400–74 B.C.	Late Archaic
50093	54	1420 ± 60	A.D. 530–756	Mesilla phase

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-26	413	491	0	9.11	Late Archaic
				7.73	Late Archaic

DL-92-27	364	517	0	4.34	Mesilla phase
				3.51	Mesilla phase
DL-92-28	345	536	0	7.77	Late Archaic
DL-92-29	384	297	0	6.78	Late Archaic
DL-92-30	371	369	0	4.06	Mesilla phase
				2.98	Mesilla phase/El Paso phase
DL-92-391	395	477	0	–	–
DL-92-392	393	483	0	6.37	Late Archaic
DL-92-393	385	492	0	2.74	El Paso phase/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	6000–4000 B.C.	Early Archaic
Projectile point	2000 B.C. –A.D. 1150	Late Archaic to Mesilla phase
El Paso Brown rim ceramic	A.D. 250–1150	Mesilla phase
Mimbres Transitional ceramic	A.D. 750–1150	Mesilla phase
El Paso Bichrome ceramic	A.D. 1150–1450	El Paso phase

Size (meters): 86,976

Erosion: Moderate | Modern Disturbance: Moderate

Surface Features: 151 | Surface Artifacts: 514

Total Features: 151 | Tested Features: 7

Feature Types:

Burned Caliche	65
Fire-cracked rock	3
Burned caliche/fire-cracked rock	72
Small stain	11

Square Meters Tested: 51 | Subsurface Artifacts: 114

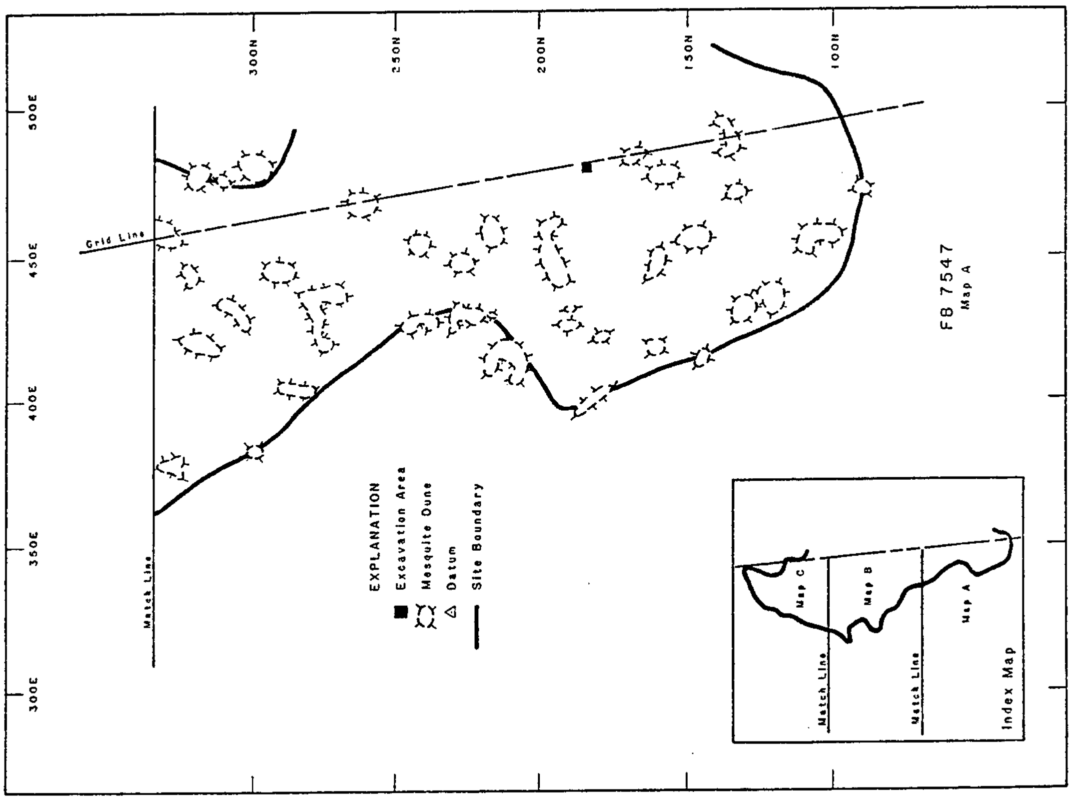
Seven surface features on the site were tested in five block excavations. The largest of these blocks was a 15-square-meter area over Features 92 and 96 in the northern portion of the site. A 12-square-meter block was placed in the central portion of the site over Feature 54. Another 12-square-meter area was excavated in the northern portion of the site area over Features 82 and 86. Eight square meters were excavated against the southwestern edge of the site over Feature 29. A 4-square-meter block was dug in the southeast corner of the site over Feature 3.

The site was revisited during Phase III and work was conducted in two of the blocks to obtain additional chronological data. Surface artifacts were collected during Phase III in only the central portion of the site. Other surface artifacts noted throughout the site were not collected.

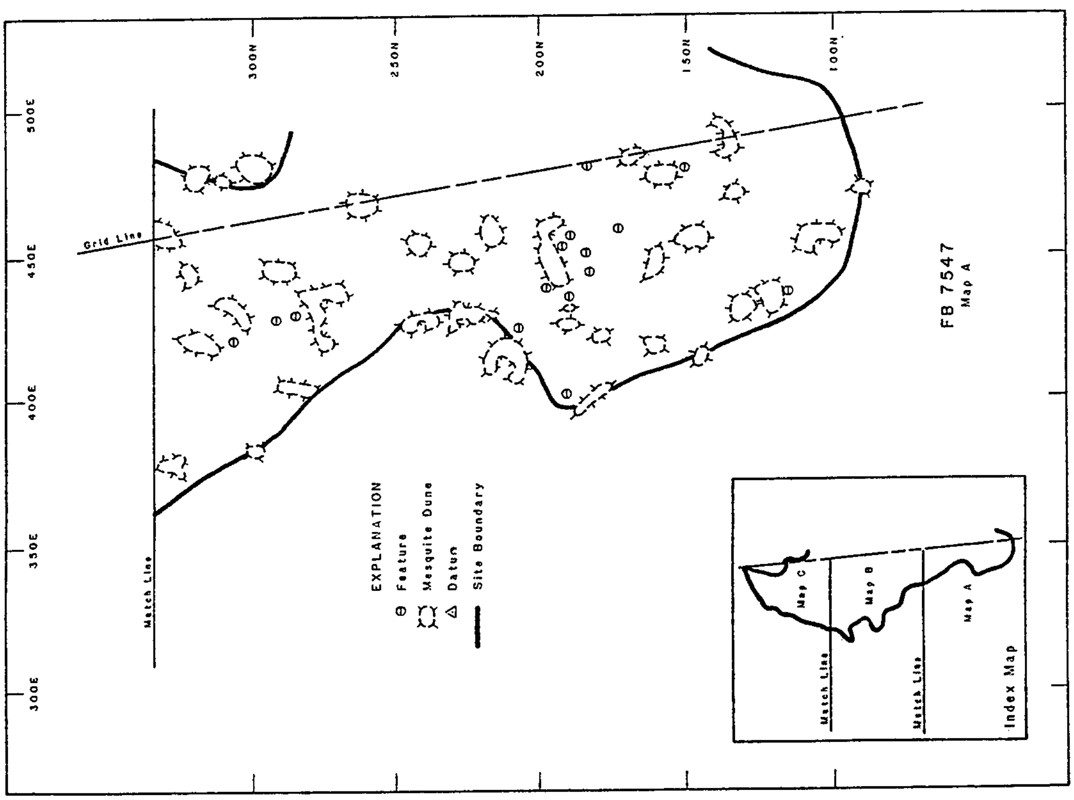
None of the excavations exhausted the research potential of subsurface material. As only 7 of the 151 features have been tested and artifacts continue to be exposed on this moderately deflated site, significant data probably remain.

Note: Sixty-six additional surface features and many artifacts were noted in the portion of the site outside the project area.

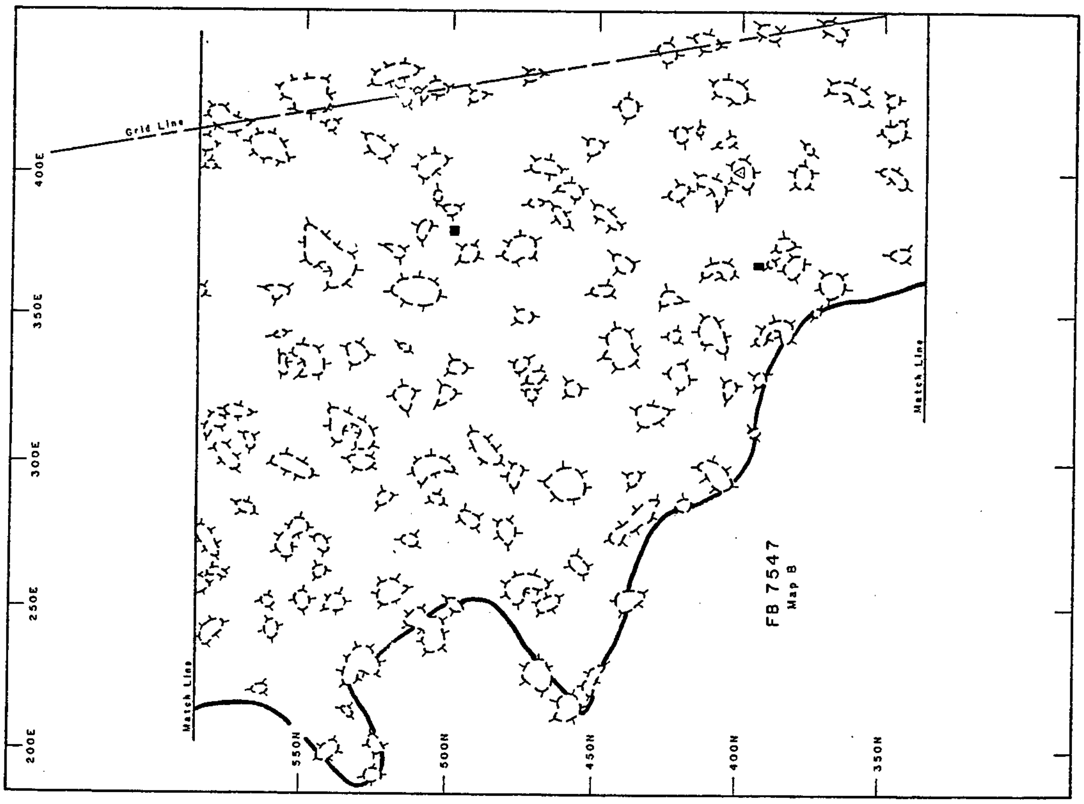
Feature No.	East	North	Type	Tested	Condition
1	436	115	Burned caliche/fire-cracked rock	No	3
2	479	151	Burned caliche	No	4
3	480	184	Small stain <1 meter	Yes	5
4	457	173	Burned caliche	No	3



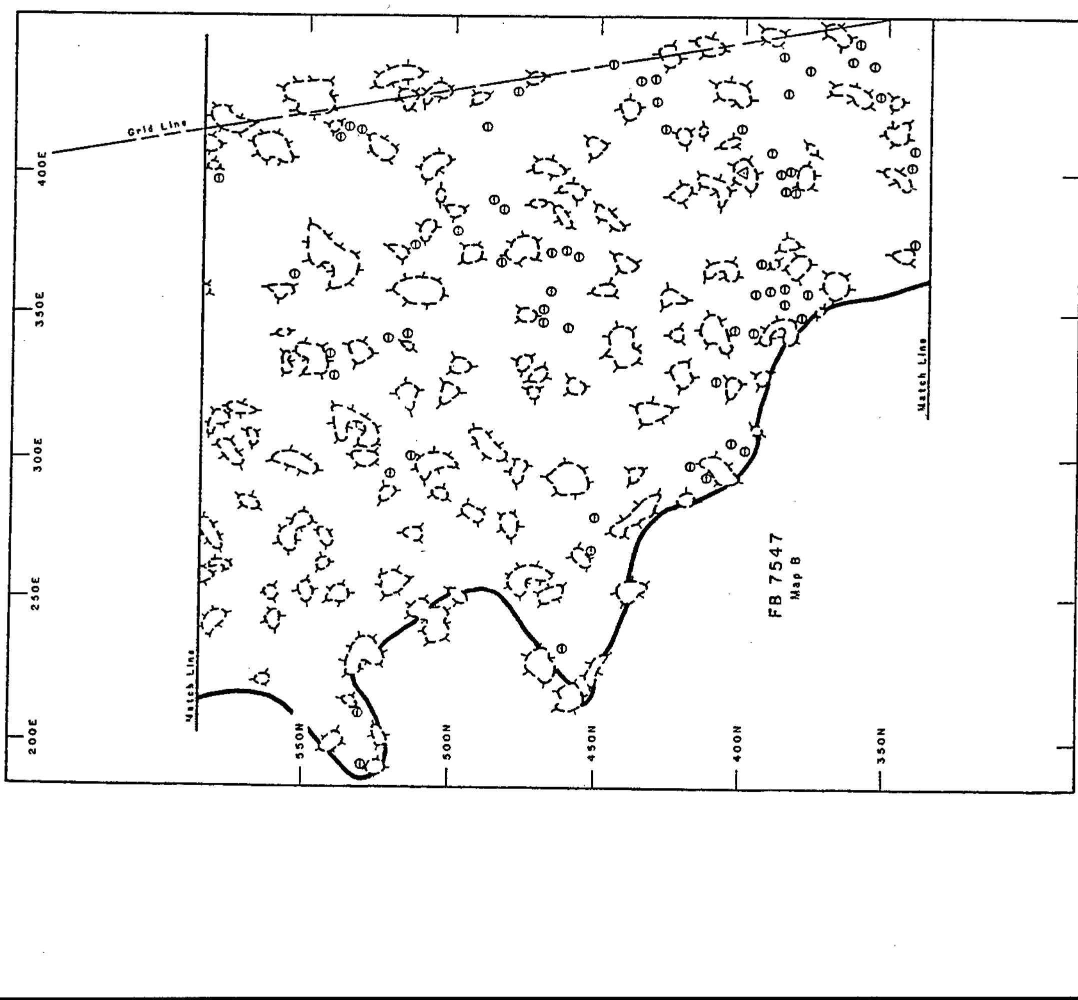
FB7547 (41EP964), Map A, Excavation Areas.



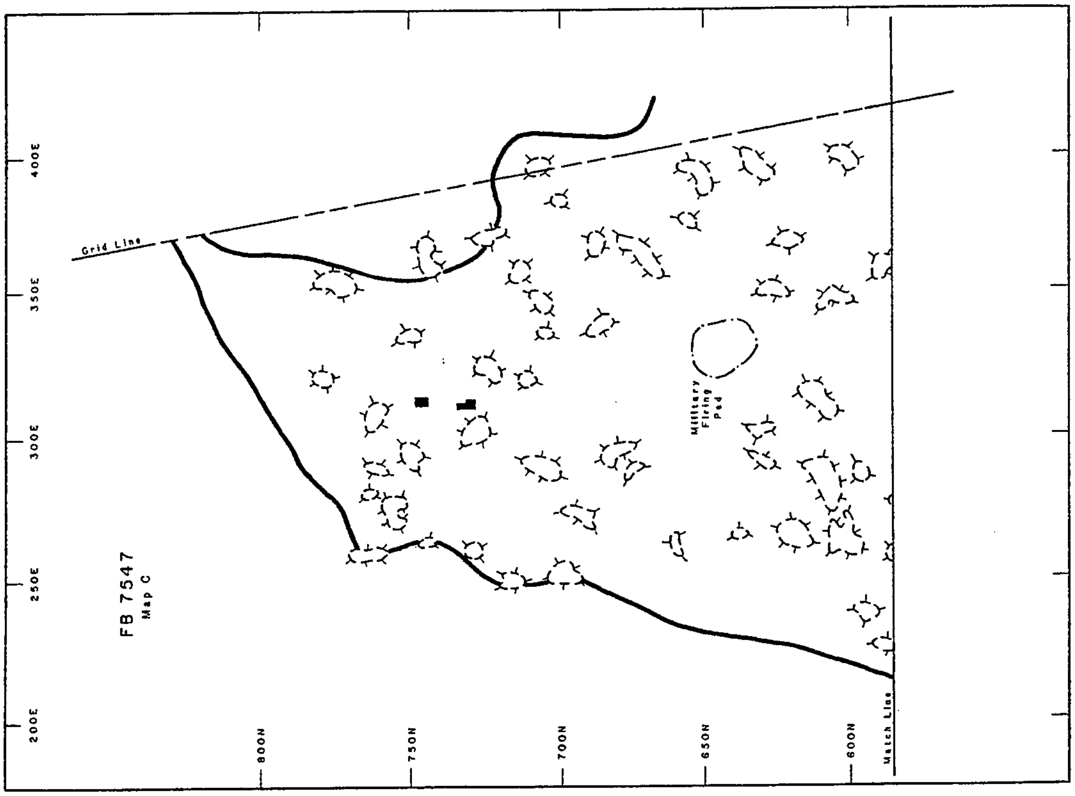
FB7547 (41EP964), Map A, Features.



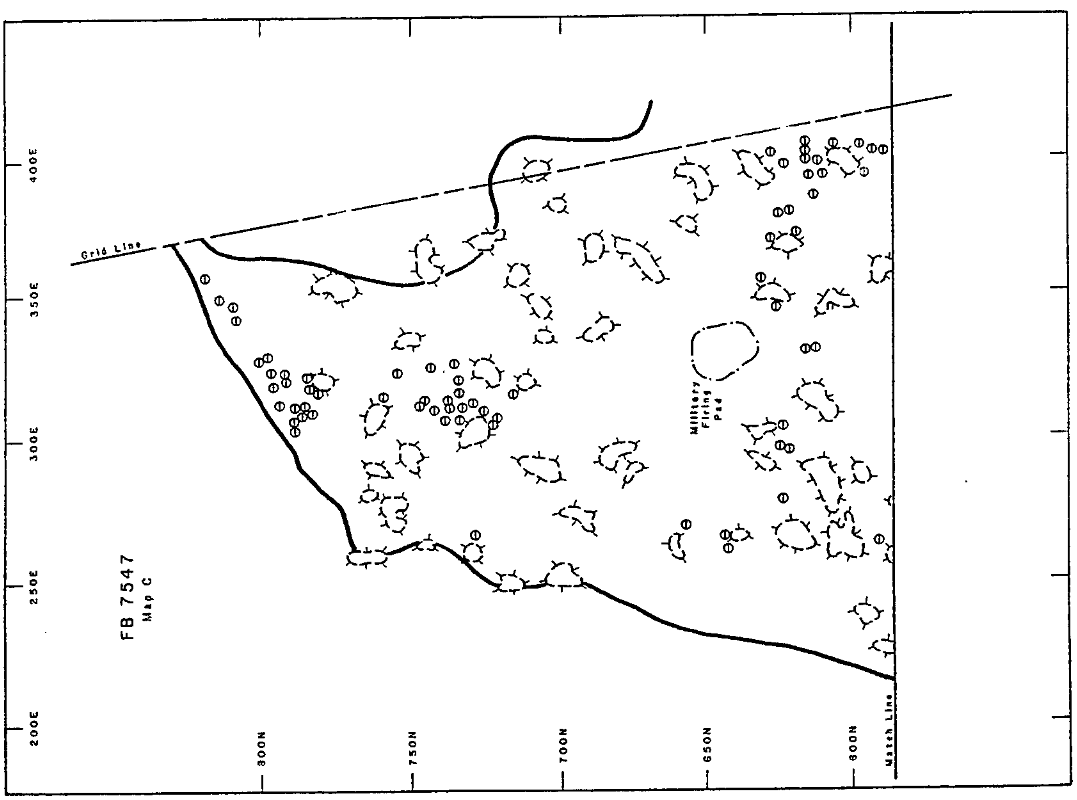
FB7547 (41EP964), Map B, Excavation Areas.



FB7547 (41EP964), Map B, Features.



FB7547 (41EP964), Map C, Excavation Areas.



FB7547 (41EP964), Map C, Features.

5	449	184	Burned caliche	No	4
6	442	183	Burned caliche	No	3
7	451	192	Burned caliche/fire-cracked rock	No	4
8	455	189	Burned caliche/fire-cracked rock	No	3
9	437	198	Burned caliche with stain	No	4
10	400	191	Small stain <1 meter	No	5
11	423	208	Burned caliche	No	3
12	428	286	Burned caliche	No	3
13	426	292	Burned caliche	No	4
14	418	307	Burned caliche with stain	No	4
15	443	360	Burned caliche/fire-cracked rock	No	5
16	437	363	Burned caliche	No	4
17	436	355	Burned caliche	No	3
18	425	353	Burned caliche	No	3
19	406	341	Burned caliche	No	2
20	400	341	Burned caliche/fire-cracked rock	No	3
21	347	379	Burned caliche	No	4
22	356	377	Burned caliche	No	3
23	352	385	Burned caliche	No	3
24	357	385	Burned caliche/fire-cracked rock	No	4
30	193	385	Burned caliche	No	6
25	355	395	Burned caliche/fire-cracked rock	No	3
26	357	390	Burned caliche with stain	No	5
27	343	396	Burned caliche/fire-cracked rock	No	3
28	343	402	Burned caliche/fire-cracked rock	No	3
29	366	394	Burned caliche	Yes	6
30	391	382	Burned caliche/fire-cracked rock	No	3
31	398	383	Burned caliche/fire-cracked rock	No	3
32	397	386	Burned caliche/fire-cracked rock	No	5
33	391	385	Burned caliche with stain	No	4
34	404	390	Burned caliche/fire-cracked rock	No	5
35	412	401	Burned caliche/fire-cracked rock	No	5
36	425	385	Burned caliche	No	3
37	434	377	Burned caliche/fire-cracked rock	No	2
38	423	430	Burned caliche	No	2
39	302	399	Burned caliche	No	2
40	292	411	Burned caliche	No	4
41	296	417	Burned caliche/fire-cracked rock	No	4
42	267	451	Fire-cracked rock	No	2
43	278	450	Fire-cracked rock	No	2
44	343	460	Burned caliche with stain	No	3
45	345	469	Burned caliche	No	2
46	356	466	Burned caliche/fire-cracked rock	No	3
47	368	457	Burned caliche with stain	No	4
48	369	466	Burned caliche	No	3
49	370	461	Burned caliche/fire-cracked rock	No	3
50	366	484	Burned caliche	No	4
51	387	485	Burned caliche/fire-cracked rock	No	4
52	384	483	Burned caliche	No	2
53	413	488	Burned caliche	No	3
54	377	499	Small stain <1 meter	Yes	5
55	372	513	Burned caliche	No	3
56	341	515	Burned caliche with stain	No	4

57	293	521	Burned caliche	No	3
58	327	541	Burned caliche	No	3
59	334	541	Burned caliche	No	4
60	361	554	Burned caliche/fire-cracked rock	No	4
61	352	631	Burned caliche/fire-cracked rock	No	5
62	366	628	Burned caliche	No	2
63	368	619	Burned caliche/fire-cracked rock	No	4
64	355	818	Burned caliche	No	3
65	348	813	Burned caliche/fire-cracked rock	No	4
66	346	809	Burned caliche/fire-cracked rock	No	4
67	341	808	Burned caliche/fire-cracked rock	No	4
68	326	800	Burned caliche/fire-cracked rock	No	3
69	327	797	Burned caliche	No	5
70	322	796	Burned caliche with stain	No	4
71	322	791	Burned caliche/fire-cracked rock	No	4
72	319	791	Burned caliche	No	3
73	310	786	Burned caliche/fire-cracked rock	No	3
74	317	795	Burned caliche/fire-cracked rock	No	2
75	310	793	Burned caliche/fire-cracked rock	No	2
76	320	784	Burned caliche/fire-cracked rock	No	4
77	316	784	Burned caliche/fire-cracked rock	No	3
78	314	781	Burned caliche/fire-cracked rock	No	3
79	307	783	Burned caliche/fire-cracked rock	No	3
80	309	788	Burned caliche/fire-cracked rock/stain	No	4
81	306	786	Burned caliche/fire-cracked rock	No	4
82	305	788	Burned caliche/fire-cracked rock	No	3
83	302	788	Burned caliche/fire-cracked rock	No	3
84	313	760	Burned caliche with stain	No	5
85	311	750	Burned caliche	Yes	4
86	313	749	Burned caliche/fire-cracked rock/stain	Yes	7
87	309	745	Burned caliche	No	2
88	321	755	Burned caliche	No	3
89	322	744	Burned caliche/fire-cracked rock	No	3
90	313	737	Burned caliche/fire-cracked rock/stain	No	4
91	311	736	Burned caliche	No	2
92	311	733	Burned caliche/fire-cracked rock/stain	Yes	5
93	314	734	Burned caliche/fire-cracked rock	No	3
94	318	735	Burned caliche	No	3
95	323	738	Burned caliche	No	3
96	310	728	Burned caliche/fire-cracked rock/stain	Yes	4
97	305	737	Burned caliche/fire-cracked rock/stain	No	5
98	305	732	Burned caliche/fire-cracked rock	No	4
99	308	726	Burned caliche/fire-cracked rock	No	3
100	305	723	Burned caliche/fire-cracked rock	No	3
101	303	723	Burned caliche/fire-cracked rock	No	4
102	313	716	Burned caliche	No	3
103	265	729	Burned caliche/fire-cracked rock	No	2
104	268	657	Burned caliche	No	3
105	264	644	Burned caliche	No	4
106	260	643	Burned caliche	No	4
107	276	624	Burned caliche	No	4
108	293	622	Burned caliche	No	3
109	294	625	Burned caliche	No	3

110	301	624	Small stain <1 meter	No	4
111	328	615	Small stain <1 meter	No	5
112	328	612	Small stain <1 meter	No	3
113	375	621	Burned caliche/fire-cracked rock	No	3
114	375	625	Burned caliche/fire-cracked rock	No	3
115	396	627	Burned caliche/fire-cracked rock	No	3
116	397	620	Burned caliche/fire-cracked rock	No	3
117	394	615	Burned caliche/fire-cracked rock	No	4
118	396	621	Burned caliche/fire-cracked rock	No	2
119	399	615	Burned caliche/fire-cracked rock	No	4
120	398	606	Burned caliche/fire-cracked rock	No	4
121	393	611	Burned caliche/fire-cracked rock	No	3
122	388	609	Burned caliche	No	4
123	389	614	Burned caliche/fire-cracked rock	No	3
124	382	612	Burned caliche/fire-cracked rock	No	3
125	389	595	Burned caliche	No	3
126	399	596	Burned caliche/fire-cracked rock	No	3
127	397	592	Burned caliche/fire-cracked rock	No	3
128	396	588	Burned caliche	No	4
129	394	580	Burned caliche/fire-cracked rock	No	3
130	209	531	Small stain <1 meter	No	4
131	192	529	Fire-cracked rock with stain	No	3
132	412	537	Burned caliche/fire-cracked rock	No	3
133	409	539	Burned caliche/fire-cracked rock	No	4
134	412	533	Burned caliche	No	3
135	426	478	Burned caliche/fire-cracked rock	No	3
136	436	445	Burned caliche	No	3
137	430	436	Burned caliche	No	3
138	430	431	Burned caliche	No	2
139	413	427	Burned caliche/fire-cracked rock/stain	No	3
140	325	408	Burned caliche	No	3
141	304	404	Burned caliche/fire-cracked rock	No	2
142	339	522	Burned caliche/fire-cracked rock	No	3
143	299	514	Burned caliche	No	2
144	392	623	Burned caliche	No	3
145	374	340	Burned caliche	No	5
146	439	387	Burned caliche/fire-cracked rock	No	2
147	343	626	Small stain <1 meter	No	4
148	434	190	Small stain <1 meter	No	4
151	233	461	Burned caliche/fire-cracked rock	No	3
152	262	590	Small stain <1 meter	No	4
153	349	468	Small stain <1 meter	No	5

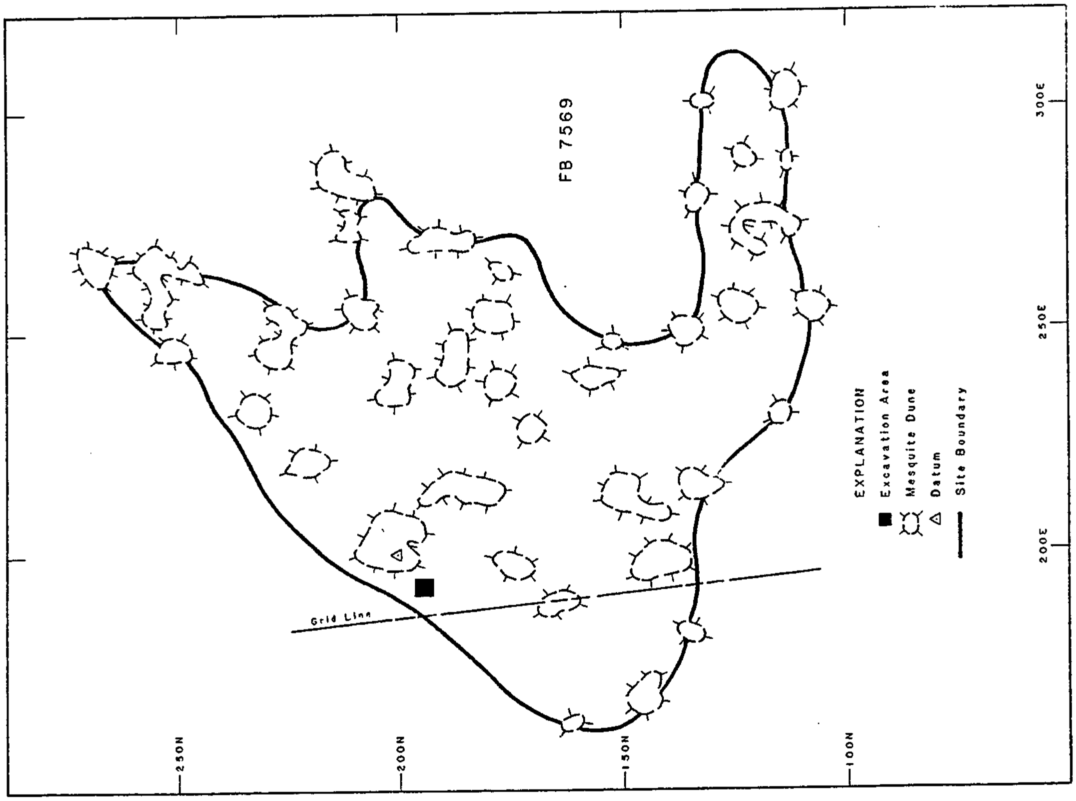
FB7569 (41EP962)

Status: 1 (significant data remaining)

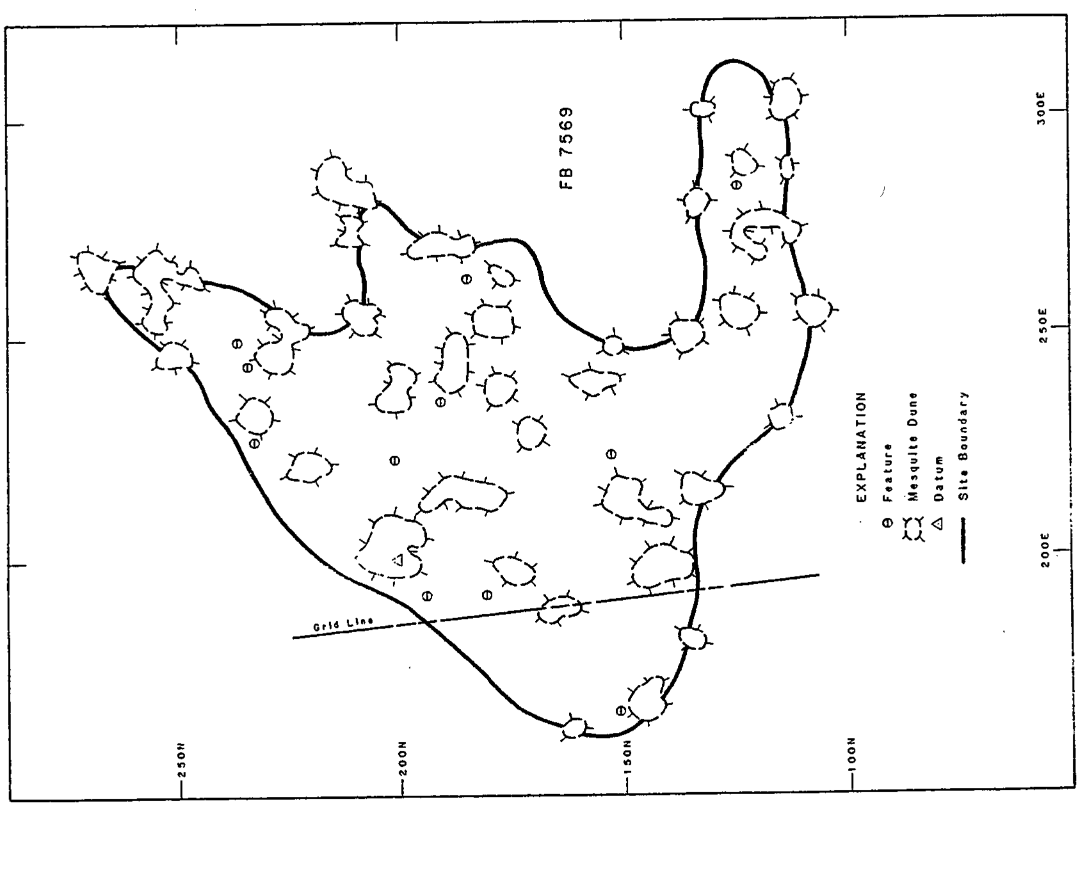
Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-394	202	172	0	2.97	Mesilla phase/El Paso phase



FB7569 (41EP962), Excavation Areas.



FB7569 (41EP962), Features.

Diagnostic Artifacts: None

Size (meters): 9,587

Erosion: Moderate | Modern Disturbance: Low

Surface Features:	11	Surface Artifacts:	47
Total Features:	12	Tested Features:	2

Feature Types:

Burned Caliche:	5
Burned caliche/fire-cracked rock:	4
Small stain:	3

Square Meters Tested: 16 | Subsurface Artifacts: 6

The site was not tested during Phase II of the project. Sixteen square meters against the west edge of the site over Feature 11 were excavated during Phase III. A few additional surface artifacts were collected in the western portion at that time.

The collection of more surface artifacts suggests that cultural materials are being exposed. Block excavations uncovered an additional feature and a few artifacts. Given this, and the fact that 10 features remain to be tested, significant data probably still remain on this site.

Feature No.	East	North	Type	Tested	Condition
1	263	185	Burned caliche	No	3
2	222	201	Burned caliche/fire-cracked rock	No	5
3	226	232	Burned caliche/fire-cracked rock	No	5
4	243	234	Burned caliche/fire-cracked rock	No	4
5	248	236	Burned caliche/fire-cracked rock	No	3
6	222	153	Burned caliche	No	3
7	284	125	Burned caliche	No	3
9	235	191	Burned caliche	No	5
10	191	180	Small stain <1 meter	No	5
11	192	194	Small stain <1 meter	Yes	4

FB7580 (41EP1753)

Status: 1 (significant data remaining)

Radiocarbon Dates:

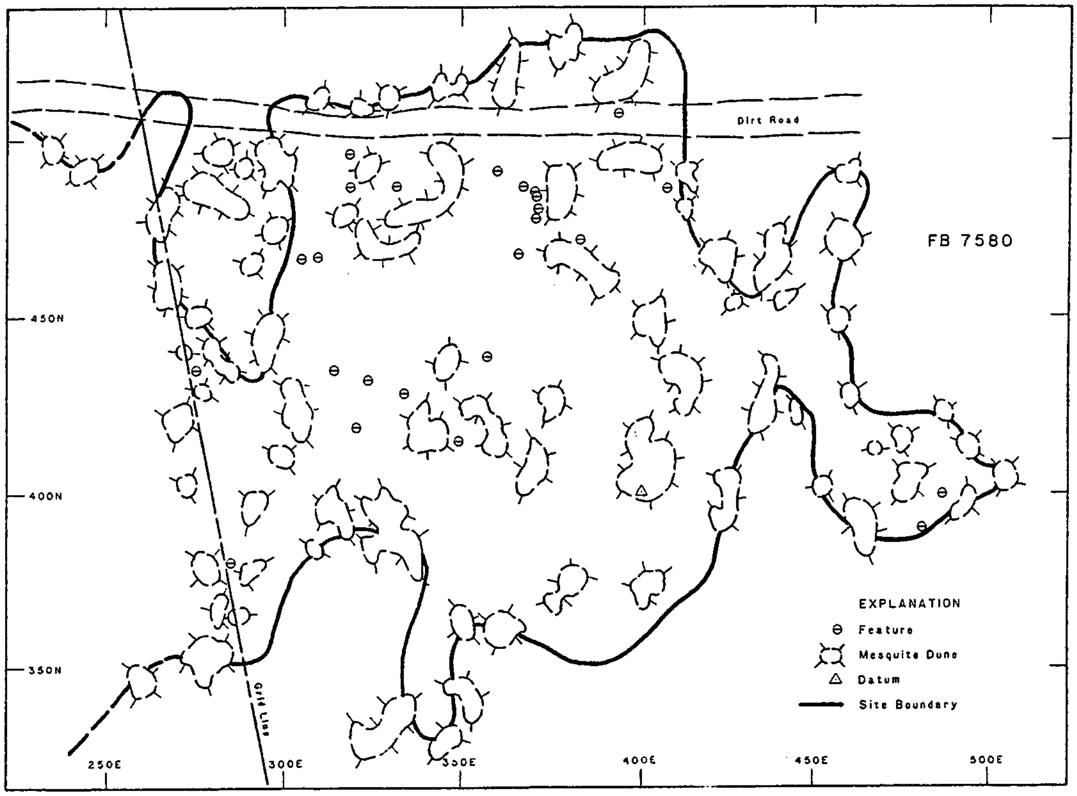
Beta #	Feature #	Date	Corrected Date	Time Period
43193	6	2800 ± 60	1210–830 B.C.	Late Archaic
43201	26	2410 ± 80	790–264 B.C.	Late Archaic
47937	8	2860 ± 60	1211–851 B.C.	Late Archaic
47938	8	2820 ± 60		
50094	4	1820 ± 50	A.D. 60–340	Late Archaic–Mesilla phase

Diagnostic Artifacts:

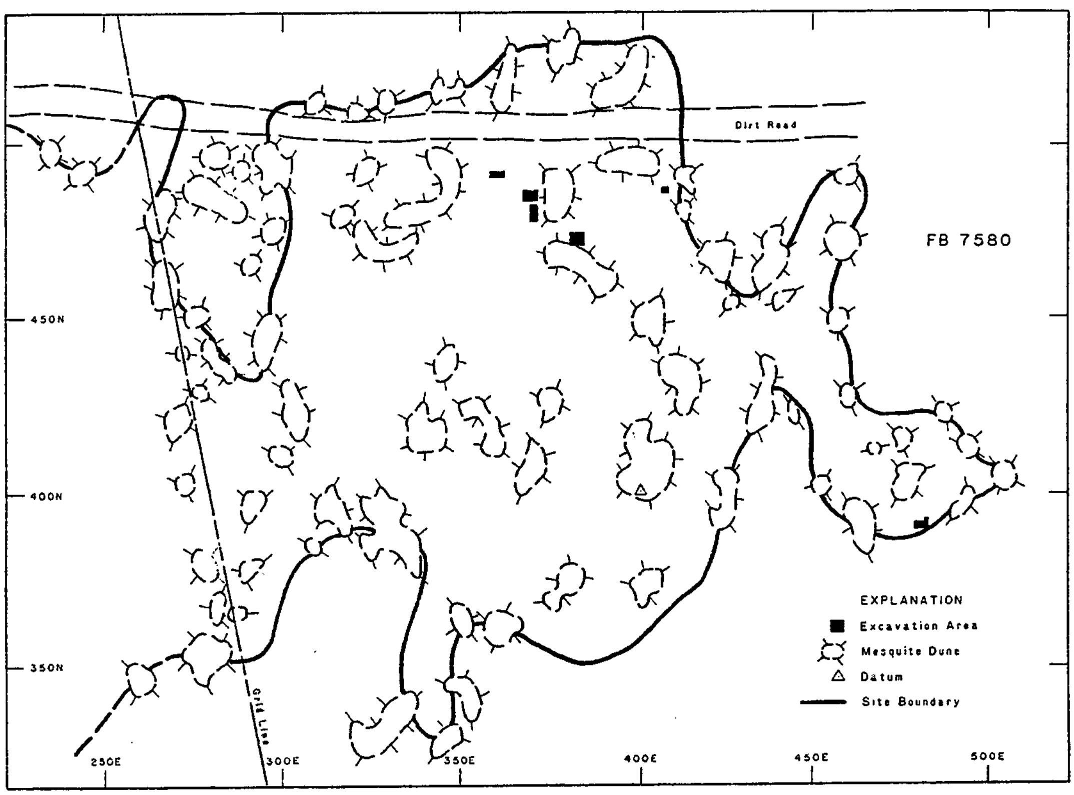
Artifact Type	Probable Date	Time Period
Projectile point	4000–2000 B.C.	Middle Archaic

Size (meters): 23,070

Erosion: Moderate | Modern Disturbance: Low



FB7580 (41EP1753) Features.



FB7580 (41EP1753) Excavation Areas.

Surface Features: 26 Surface Artifacts: 163
Total Features: 29 Tested Features: 12
Feature Types:

Burned Caliche	9
Burned caliche/fire-cracked rock	11
Small stain	9

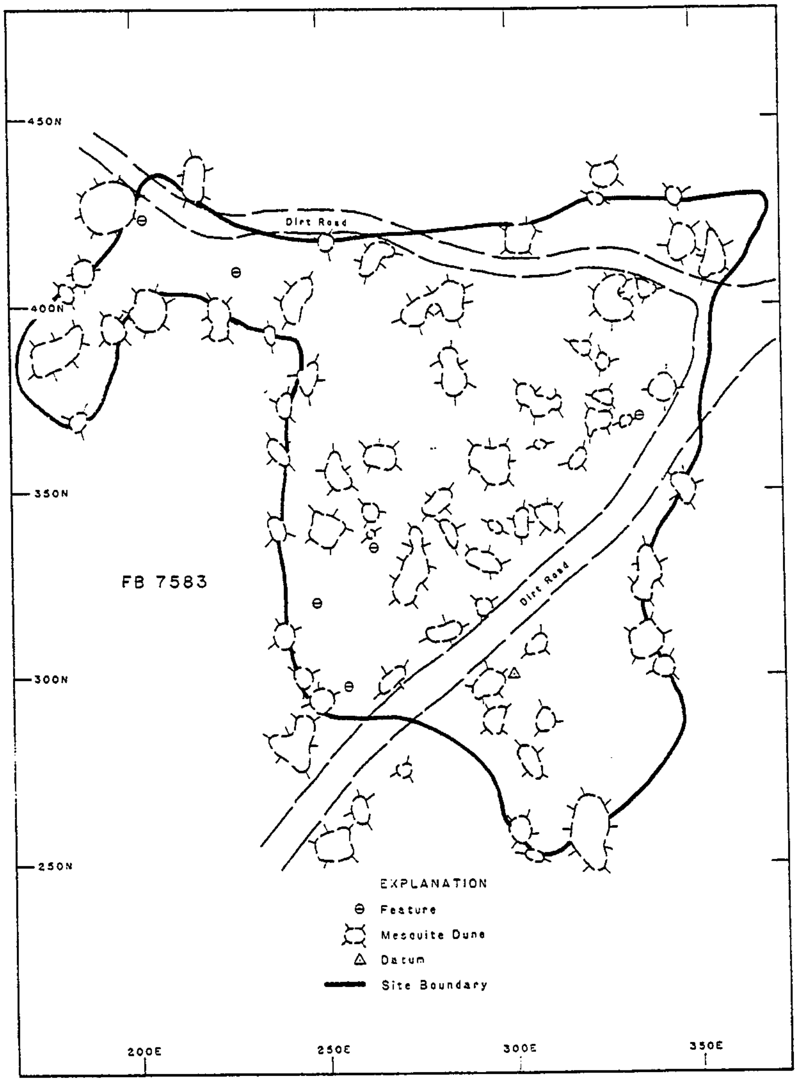
Square Meters Tested: 59 Subsurface Artifacts: 23

The site was tested in six block excavations conducted during Phase II and Phase III. The largest of the blocks was a 16-square-meter area over Feature 4; 12 square meters were tested over Features 7–9, a 9-square-meter area was over Feature 5 and 6, 9 square meters were over Feature 11, and finally 4 square meters were over Feature 13, all in the northeast. The last block was placed in the southeast portion of the site over Feature 1.

An additional feature and several new surface artifacts were noted during Phase III. These were not collected. Artifacts are being exposed. Block excavations uncovered a few subsurface features and a low density of subsurface cultural materials. None of the block excavations exhausted the horizontal extent of subsurface material. FB7580 continues to the west of central grid quad (southernmost quad), though this area of the site was not surface collected and the features were not formally recorded.

The number of features, the results of the testing conducted, the area of the site outside grid quad that was not dealt with, the exposure of cultural material, and the moderate deflation of the sites indicate significant data remain.

Feature No.	East	North	Type	Tested	Condition
1	481	392	Small stain <1 meter	Yes	6
2	487	399	Burned caliche	No	5
3	365	466	Burned caliche/fire-cracked rock	No	5
4	384	471	Small stain <1 meter	Yes	5
5	369	480	Burned caliche with stain	Yes	5
6	371	481	Small stain <1 meter	Yes	7
7	371	483	Small stain <1 meter	Yes	5
8	372	489	Small stain <1 meter	Yes	5
9	368	488	Burned caliche with stain	Yes	4
10	357	438	Burned caliche/fire-cracked rock/stain	No	3
11	360	493	Fire-cracked rock with stain	Yes	6
12	392	506	Burned caliche	No	3
13	407	488	Burned caliche	Yes	7
14	317	495	Burned caliche	No	5
15	317	486	Small stain <1 meter	No	5
16	330	486	Burned caliche/fire-cracked rock/stain	No	5
17	304	465	Burned caliche	No	6
18	308	466	Burned caliche/fire-cracked rock	No	6
19	332	427	Burned caliche/fire-cracked rock	No	6
20	322	431	Burned caliche/fire-cracked rock	No	4
21	313	434	Burned caliche/fire-cracked rock	No	5
22	319	418	Small stain <1 meter	No	5
23	348	414	Burned caliche/fire-cracked rock	No	3
24	274	434	Small stain <1 meter	No	5
25	283	380	Burned caliche	No	5
27	336	484	Small stain <1 meter	No	7



FB7583 (41EP1750).

FB7583 (41EP1750)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

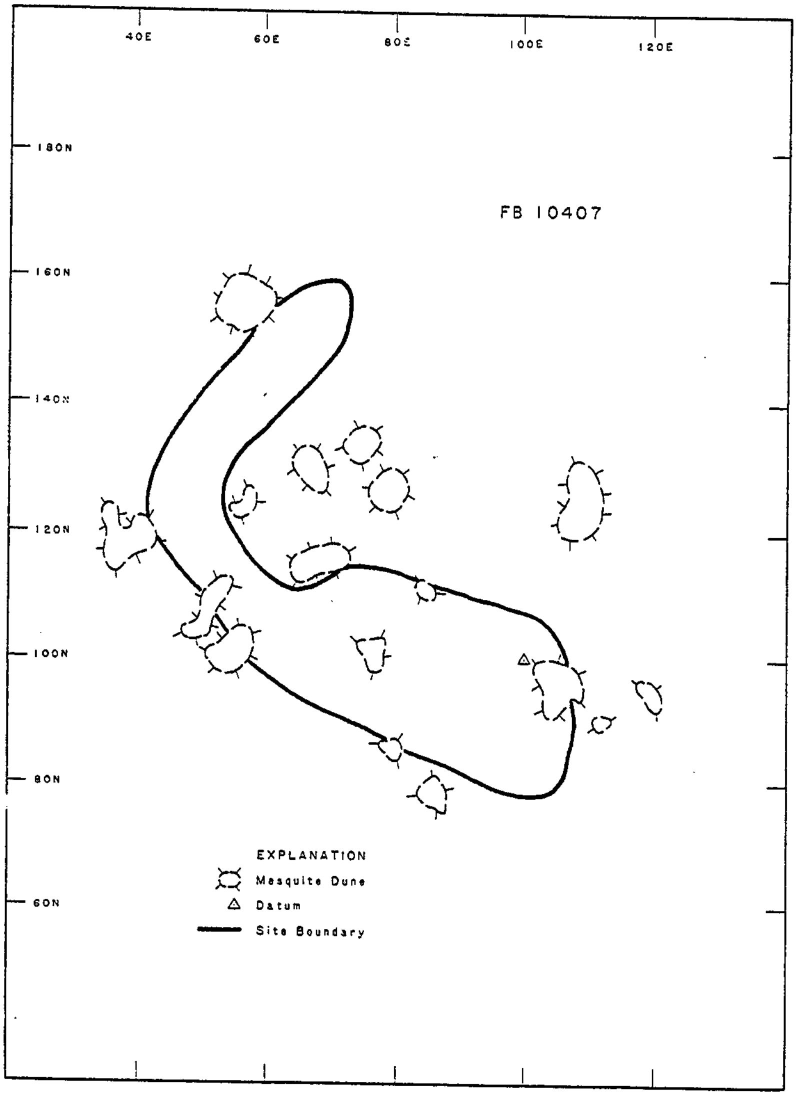
Lab #	East	North	Level	Rim Width	Time Period
DL-92-395	352	363	0	–	–
DL-92-396	352	363	0	–	–
DL-92-397	329	418	0	2.53	El Paso phase/Mesilla phase

Diagnostic Artifacts: None

Size (meters): 17,786

Erosion: Severe

Modern Disturbance: Severe



FB10407.

Surface Features:	6	Surface Artifacts:	34
Total Features:	6	Tested Features:	0

Feature Types:

Burned caliche	2
Small stain	4

Square Meters Tested: 0

Subsurface Artifacts: 0

Surface artifacts were collected during Phase II. No testing was done on this site and the site was not revisited during Phase III. The subsurface potential is minimal as the site is severely deflated and modern disturbance is widespread. Nevertheless, none of the features were tested so significant data may still remain.

Feature No.	East	North	Type	Tested	Condition
1	248	319	Small stain <1 meter	No	5
2	256	297	Small stain <1 meter	No	3
3	264	334	Small stain <1 meter	No	5

4	228	409	Burned caliche	No	3
5	202	422	Burned caliche	No	3
6	335	369	Small stain <1 meter	No	4

FB10407

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 2,285

Erosion: Severe — Modern Disturbance: Severe

Surface Features: 0 — Surface Artifacts: 9
Total Features: 0 — Tested Features: 0
Feature Types: None

Square Meters Tested: 0 — Subsurface Artifacts: 0

The surface artifacts of this site were collected during Phase II. Initial assessments suggested the site was extremely deflated, disturbed by modern army activity, and lacked features. These assessments indicated the site lacked any additional research potential. The site was visited during Phase III to verify the lack of additional cultural evidence along with reassessing the amount of surface deflation and disturbance. Initial assessments of this site were correct; the site lacks any remaining research potential.

FB10408

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 560

Erosion: Low — Modern Disturbance: Low

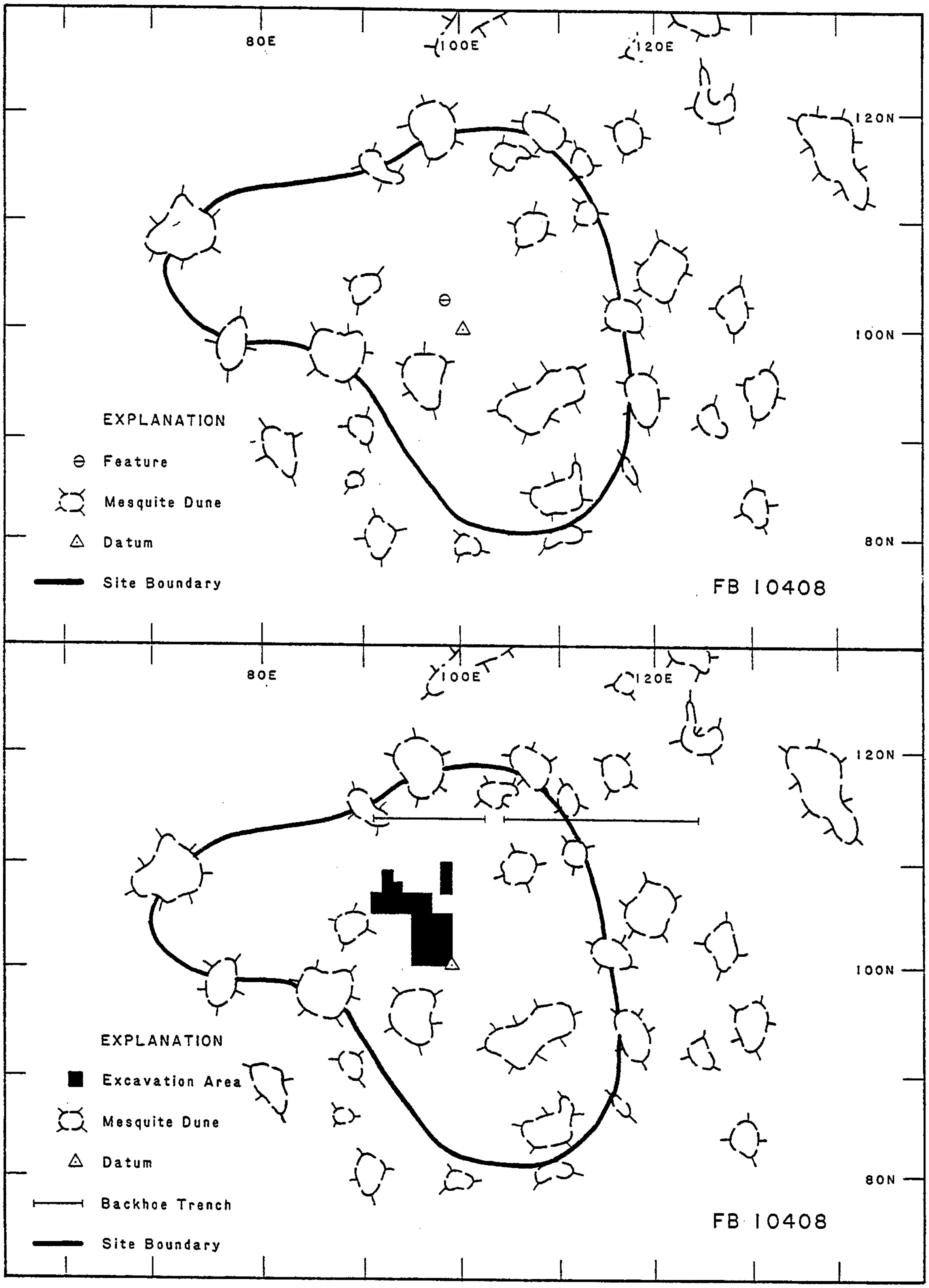
Surface Features: 1 — Surface Artifacts: 4
Total Features: 1 — Tested Features: 1
Feature Types:

Burned caliche/fire-cracked rock 1

Square Meters Tested: 38 — Subsurface Artifacts: 0
Backhoe Trenches: 2 = 22 square meters

Three block excavations and two backhoe trenches were established to mitigate this site. A single burned caliche/fire-cracked rock feature represented the entire site, with the exception of a few additional scattered burned caliche and fire-cracked rock pieces over the remainder of the site.

The largest block excavation was a 20-square-meter area placed over the major portion of the feature. A 15-square-meter block was adjacent and northwest of the Feature 1 block to test an area of burned caliche on the surface. The final area was a 1-by-3-square-meter trench excavated to the north- northeast of the Feature 1 block to test an area of built-up interdunal sands. The two backhoe trenches were placed against the north edge of the site in a large dune field.



FB10408. *Top,* features; *bottom,* excavation areas.

No additional features or artifact concentrations were uncovered. Excavations and surface collections on this site exhausted the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	98	105	Burned caliche/fire-cracked rock	Yes	2

FB10409

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 817

Erosion: Low   Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	4
Total Features:	2	Tested Features:	2

Feature Types:

Burned caliche/fire-cracked rock	1
Small stain	1

Square Meters Tested: 47   Subsurface Artifacts: 1

Backhoe Trenches: 2 = 16 square meters

Three block excavations and two backhoe trenches were established on this site. The largest block consisted of a 42-square-meter area placed over the only surface feature. Three square meters were established in the northeast portion of the site in an area where a single utilized lithic flake was found on the surface. The final excavation area was a 1-by-2-meter trench in the northwest portion of the site on the east edge of a mesquite dune. The backhoe trenches were placed in the northwest and northeast portions of the site.

One additional feature was found below the surface in the 1-by-2-meter excavation trench. This feature was determined to be a modern ash stain and no additional excavations were conducted. No subsurface artifact concentrations were uncovered. The excavations and surface collections exhausted the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	97	96	Burned caliche/fire-cracked rock/stain	1	7

FB10410

Status: 2 (requires additional testing)

Radiocarbon Dates: None

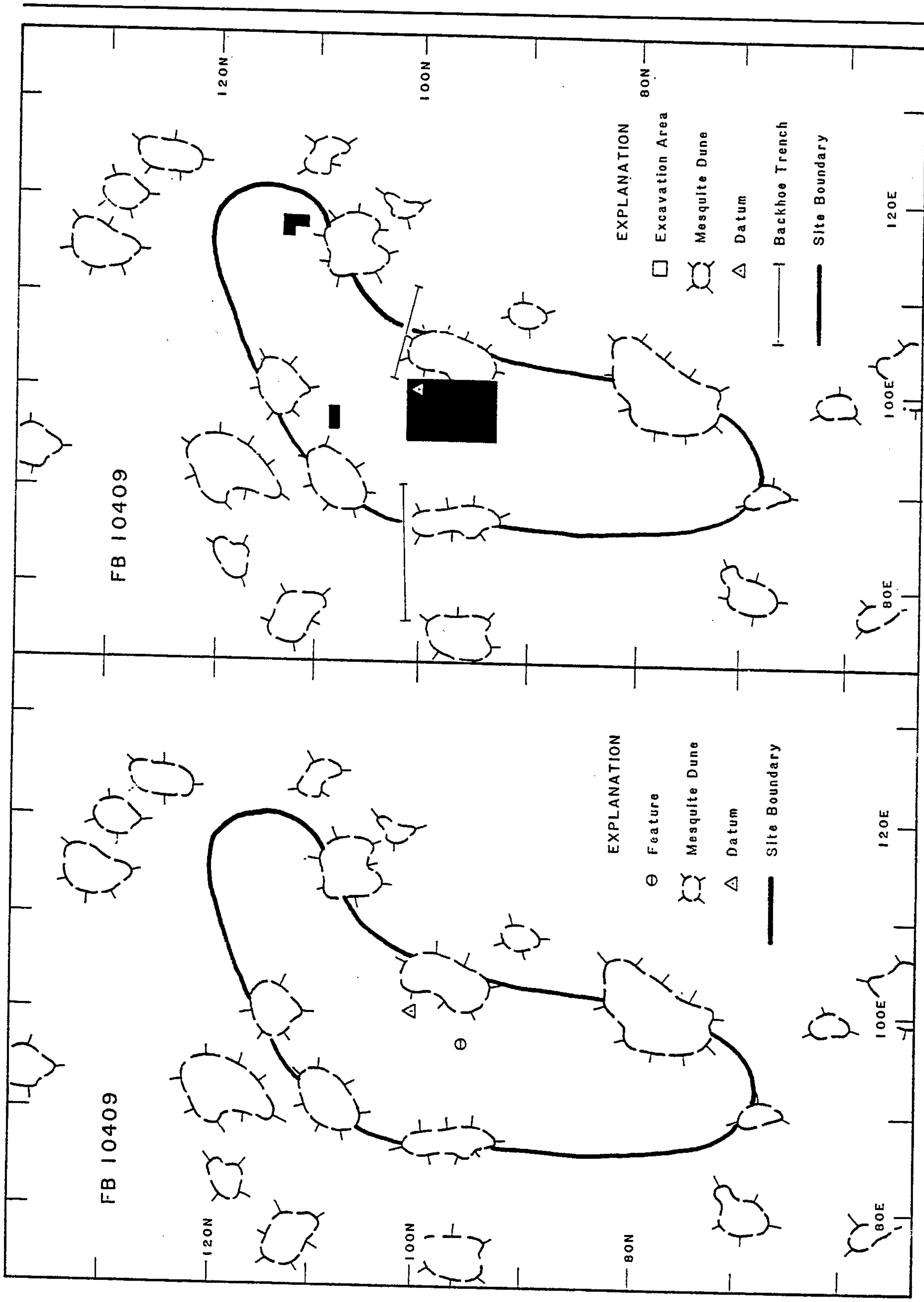
Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-37	303	283	0	4.19	Mesilla phase
				3.11	Mesilla phase/El Paso phase

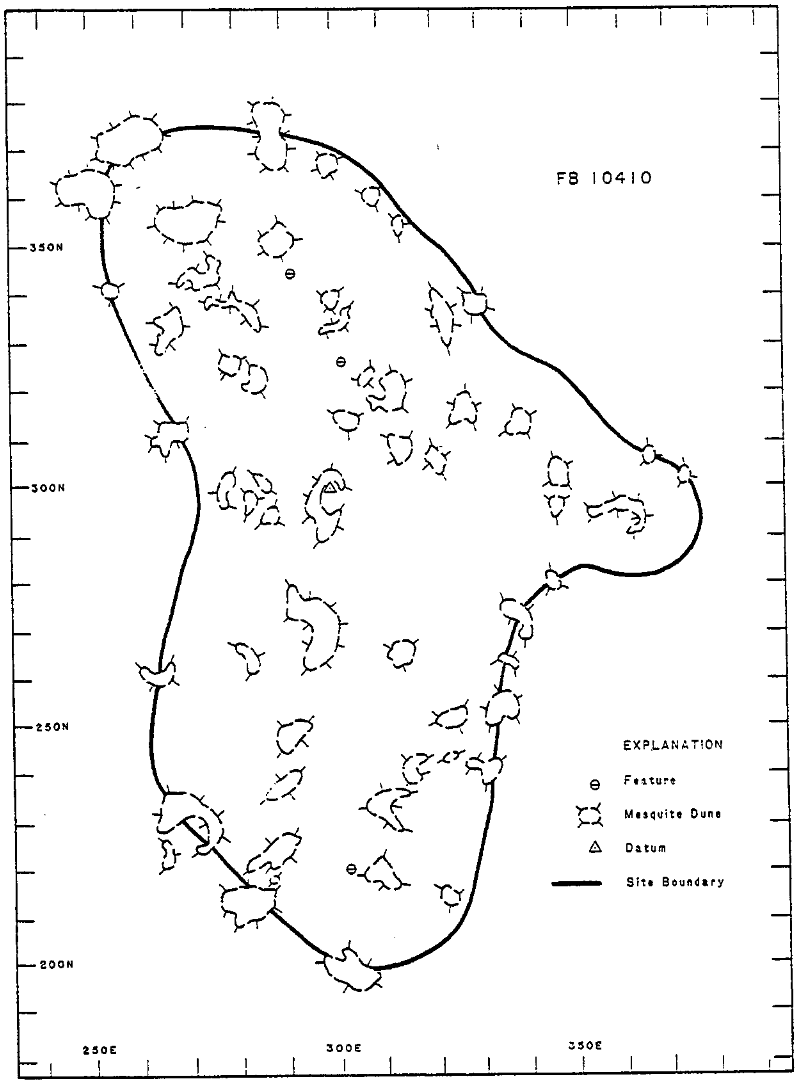
Diagnostic Artifacts: None

Size (meters): 9,196

Erosion: Moderate   Modern Disturbance: Low



Site FB10409. *Left*, feature; *right*, excavation area.



FB10410 Features.

Surface Features:	3	Surface Artifacts:	38
Total Features:	3	Tested Features:	0
Feature Types:			
Burned caliche		3	
Square Meters Tested: 0		Subsurface Artifacts: 0	

Surface artifacts were collected during Phase II of the project. No testing was conducted. Significant data may remain given the lack of testing and the moderate erosion.

Feature No.	East	North	Type	Tested	Condition
1	303	221	Burned caliche	No	1
2	292	345	Burned caliche	No	2
3	302	327	Burned caliche	No	2

FB10411

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43202	16	680 ± 70	A.D.1220–1410	El Paso phase
47939	17	860 ± 60	A.D.1020–1280	Mesilla phase/El Paso phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period
El Paso Polychrome ceramics	A.D. 1150–1450	El Paso phase
Projectile point	A.D. 1150–1450	El Paso phase

Size (meters): 11,921

Erosion: Low — Modern Disturbance: Moderate

Surface Features:	16	Surface Artifacts:	151
Total Features:	18	Tested Features:	9

Feature Types:

Burned caliche	10
Burned caliche/fire-cracked rock	4
Small stain	3
Large stain	1

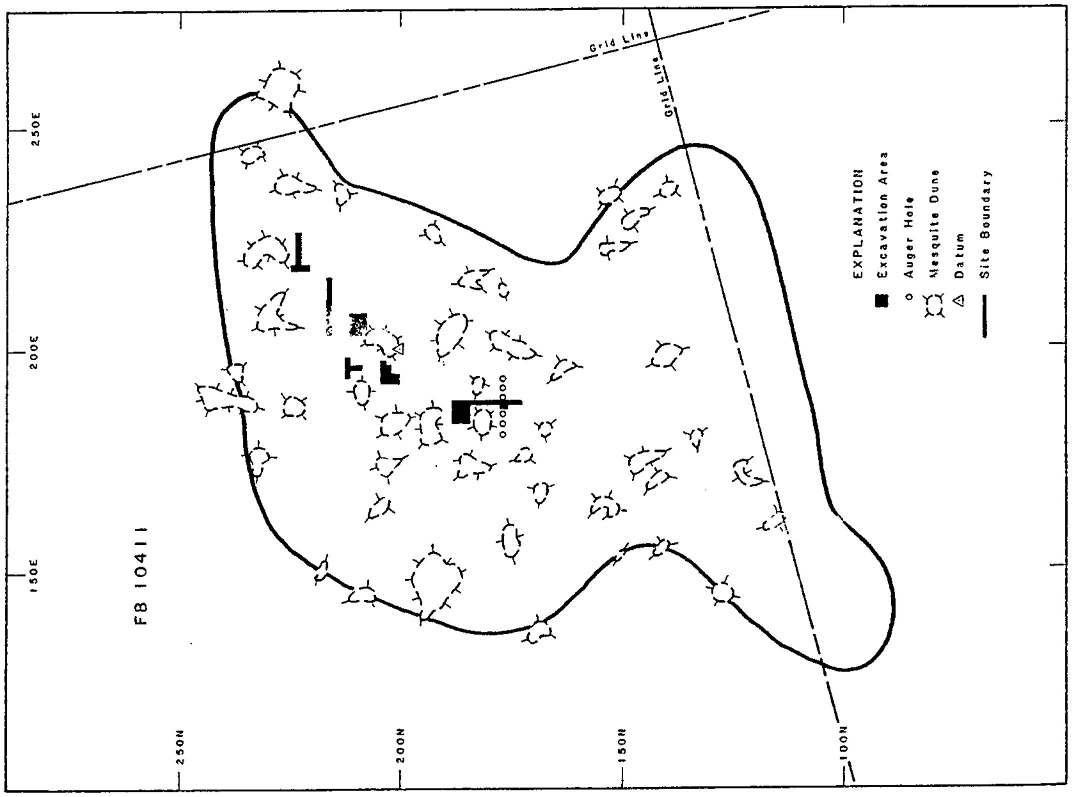
Square Meters Tested: 98 — Subsurface Artifacts: 165

Auger Holes: 6

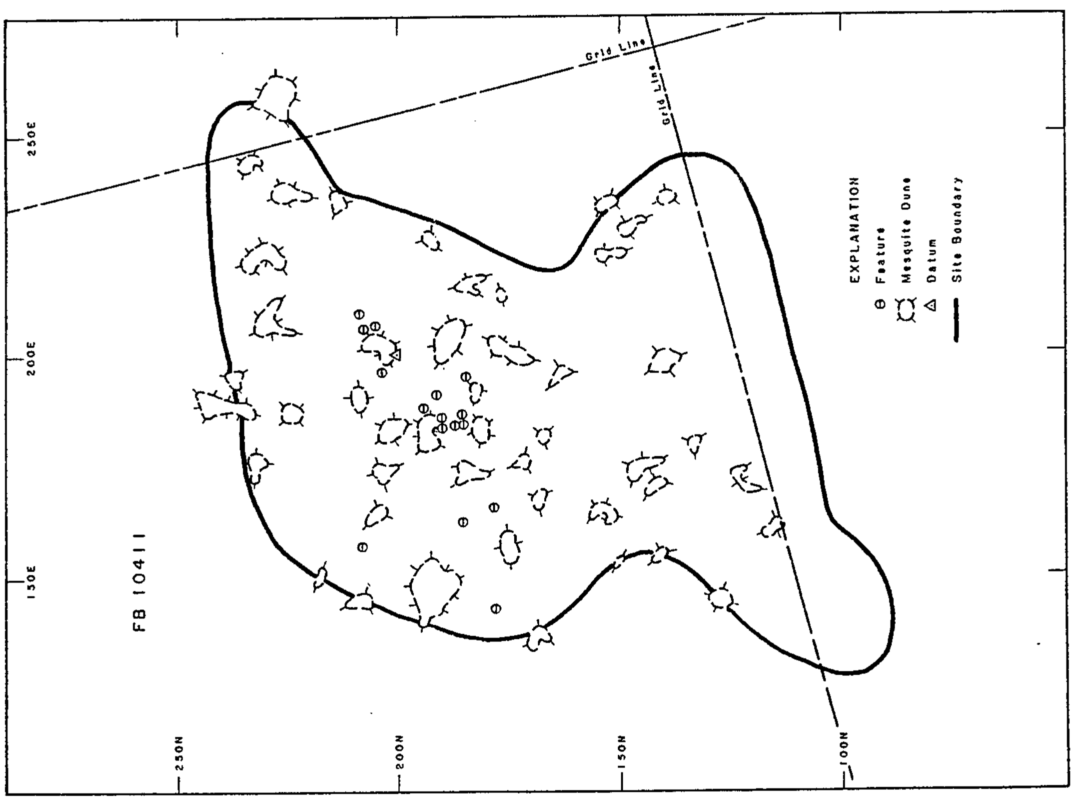
All excavations on FB10411 were conducted in the north half of the site to test six surface features and determine subsurface densities of cultural evidence. Two testing techniques were used on the site. As on other sites, most of the investigation was conducted by the excavation of large blocks around features. In addition, four 1-meter-wide test trenches were hand excavated to investigate the possibility of pueblo walls. This technique, which maximized linear exposure, had a higher probability of encountering pueblo walls.

The largest block excavation was a 20-square-meter area over Features 9, 11, and 12. This block adjoined a 1-by-12 meter trench excavated to the southeast. This trench excavation included an initial 4-square-meter block that tested a dune covered in darker surface soils. Two of the 4 square meters encompassed by the trench were the only units excavated to sterile soils. The other 2 square meters were not entirely excavated. The 12-meter-long trench was excavated to define subsurface Feature 16 (possible house) from south to north. Other block excavations and trenches were:

19-square-meter block over Features 1–3
13-square-meter block over and west of Feature 17
13-meter-long west-to-east trench north and northeast of Feature 1–3 block
1-by-4-meter south-to-north trench on the west edge
1-by-7 meter west-to-east trench adjoining 1-by-4-meter trench
1-by-3-meter south-to-north trench against south edge north of the Feature 17 block and west of the Feature 1–3 block
1-by-5-meter trench from west to east adjoining 1-by-3-meter trench



FB10411 Excavation Areas.



FB10411 Features.

A second time surface collection during Phase III indicated cultural materials are being exposed. Test excavations revealed subsurface cultural evidence throughout the areas tested and none of the excavation areas exhausted the research potential.

As cultural materials are being exposed, a possible El Paso phase pit structure was present and cultural materials were found in all excavations, significant data remain on this moderately deflated site.

Feature No.	East	North	Type	Tested	Condition
1	209	208	Burned caliche	Yes	3
2	206	207	Burned caliche/fire-cracked rock	Yes	4
3	206	205	Burned caliche	Yes	4
4	191	191	Burned caliche	No	3
5	188	194	Burned caliche/fire-cracked rock	No	4
6	188	189	Burned caliche	No	3
7	185	189	Burned caliche	No	3
8	194	183	Burned caliche	No	2
9	186	185	Small stain <1 meter	Yes	2
10	152	185	Burned caliche	No	3
11	186	186	Burned caliche with stain	Yes	5
12	186	183	Small stain <1 meter	Yes	2
13	143	178	Burned caliche/fire-cracked rock	No	3
14	165	178	Small stain <1 meter	No	5
15	157	208	Burned caliche	No	2
17	196	203	Small stain <1 meter	Yes	6

FB10412

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 516

Erosion: Severe

Modern Disturbance: Low

Surface Features: 1

Total Features: 2

Surface Artifacts: 6

Tested Features: 2

Feature Types:

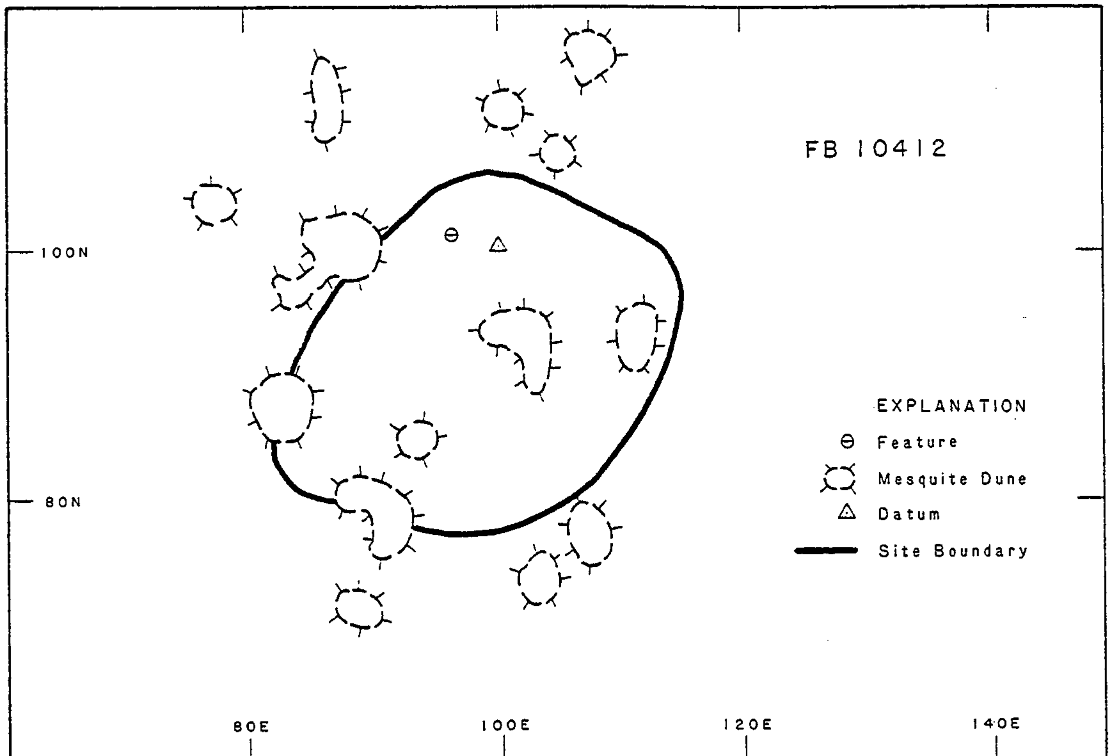
Small stain 2

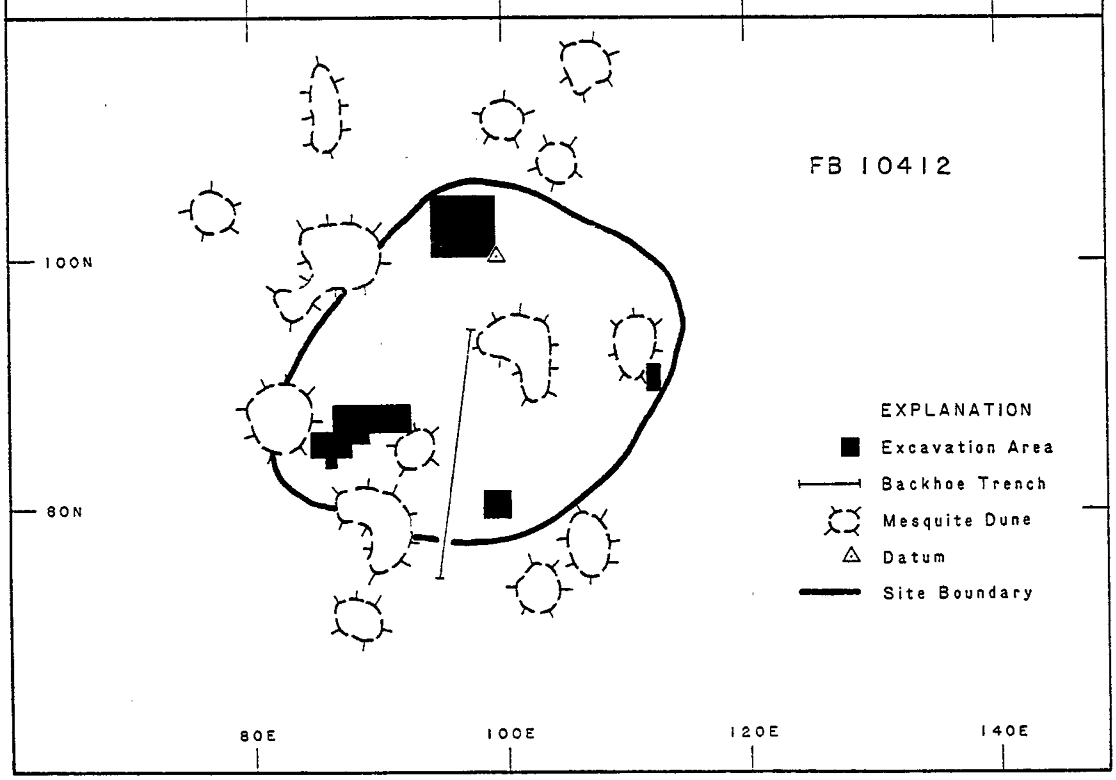
Square Meters Tested: 52

Backhoe Trenches: 1 = 8 square meters

Subsurface Artifacts: 4

Four block excavations and a single backhoe trench were excavated on this site. The largest block excavation was a 25-square-meter area established against the north edge of the site over the single surface feature. Another block of 21 square meters was placed in the southeast portion over an area where a few surface unidentifiable brownware body ceramics were uncovered. A 4-square-meter block was established in the south portion of the site where a single utilized flake was uncovered. The final block was a 1-by-2-meter area to test the east edge of the site where a single piece of burned caliche was noted on the surface. A single backhoe trench was excavated through the central portion of the site.





FB10412. *Top,* features; *bottom,* excavation areas.

An additional feature was uncovered in the largest block excavation, though it was modern. No subsurface artifact concentrations were uncovered within any of the block excavations. The surface collections and the excavations conducted exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	96	101	Small stain <1 meter	1	5

FB10413

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 243

Erosion: Severe — Modern Disturbance: Low

Surface Features: 1 — Surface Artifacts: 9
Total Features: 1 — Tested Features: 1
Feature Types:

Fire-cracked rock 1

Square Meters Tested: 56 — Subsurface Artifacts: 76
Backhoe Trenches: 1 = 11 square meters

A 56-square-meter block and a single backhoe trench were excavated on this site. A fire-cracked rock feature and a few scattered pieces of associated fire-cracked rock were on the surface. The block excavation area encompassed the majority of surface cultural manifestations. The single backhoe trench was excavated in the southwest portion of the site.

No additional features or artifact concentrations were uncovered. Excavations and surface collections exhausted the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	187	194	Fire-cracked rock	1	5

FB10414

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

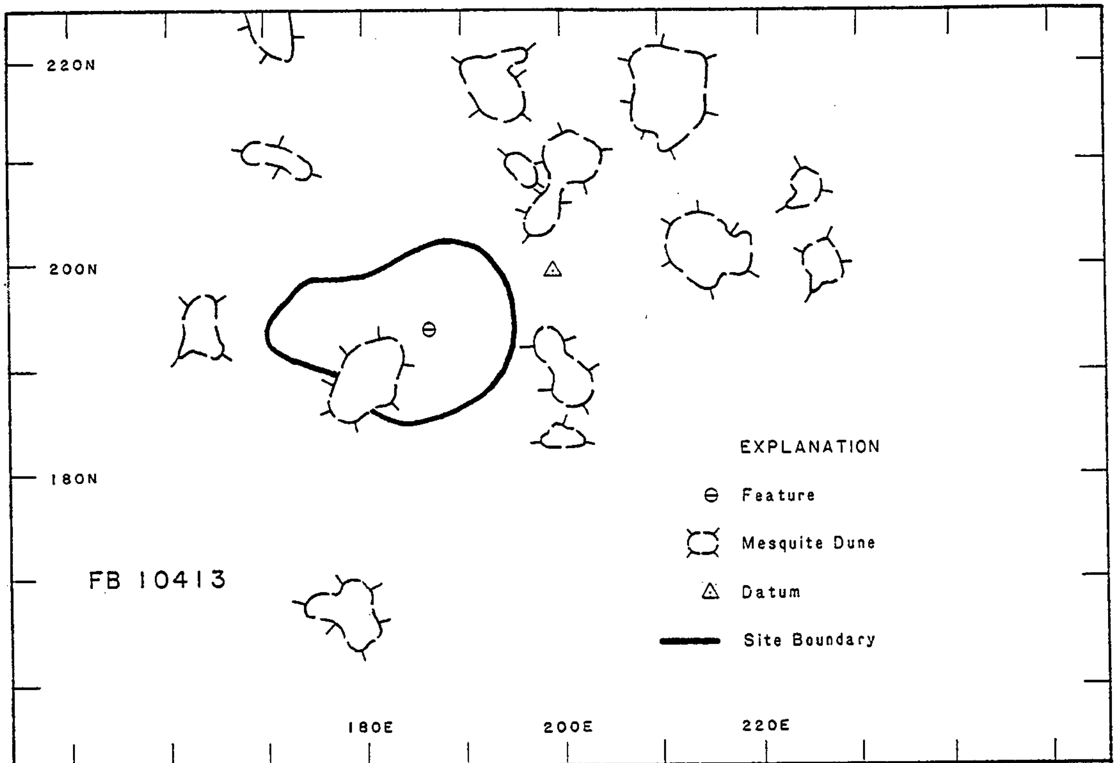
Size (meters): 717

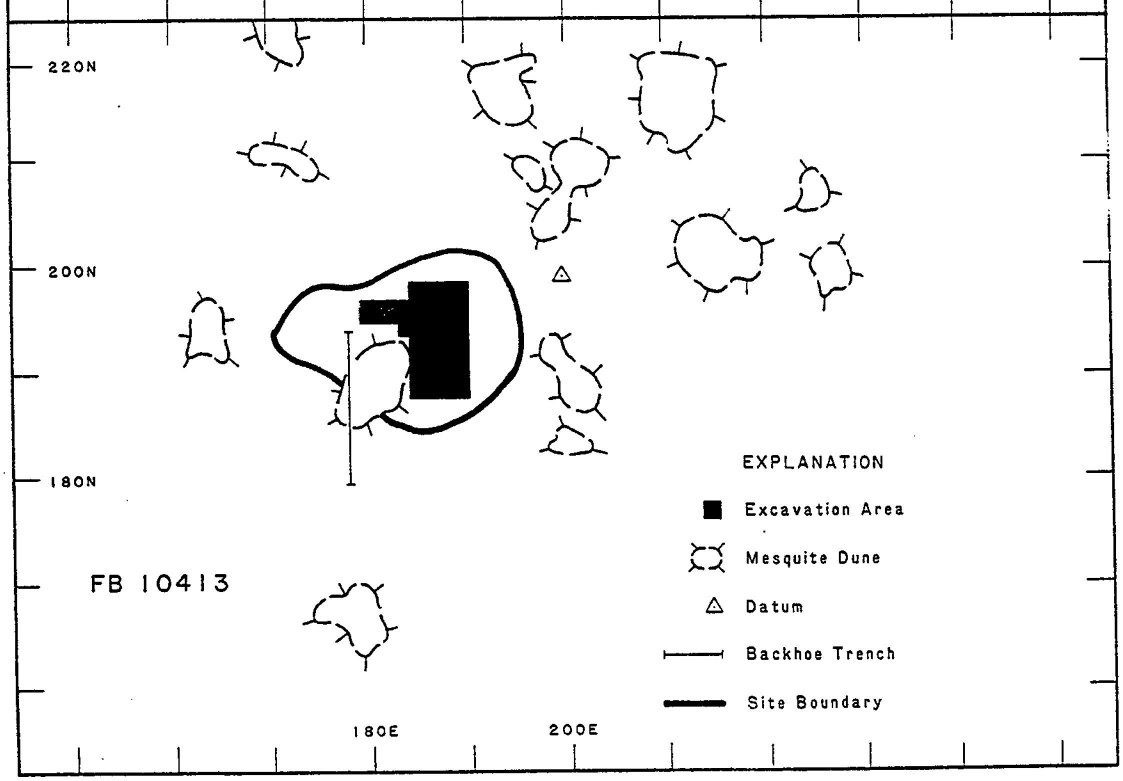
Erosion: Moderate — Modern Disturbance: Low

Surface Features: 1 — Surface Artifacts: 1
Total Features: 1 — Tested Features: 1
Feature Types:

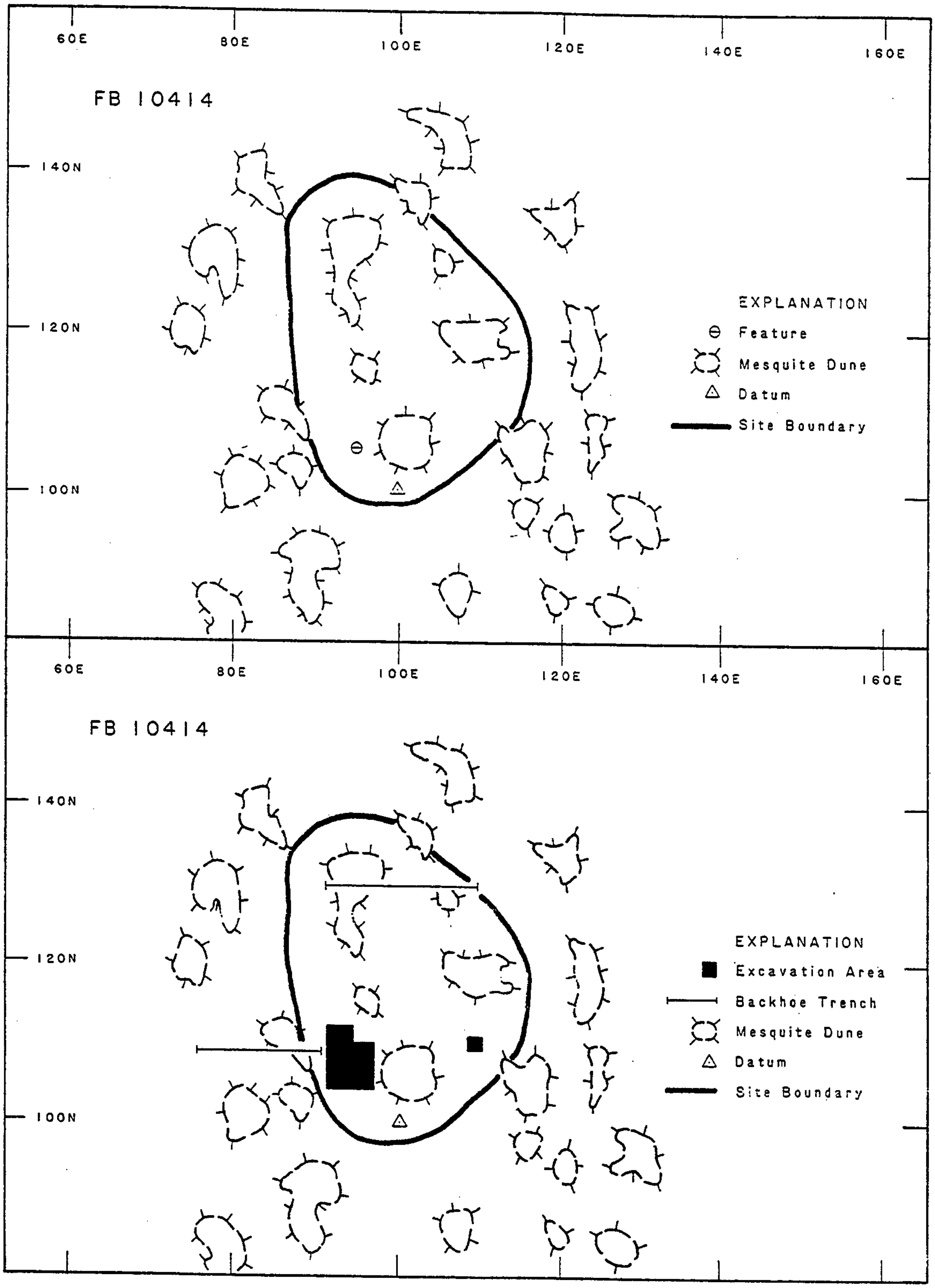
Burned caliche/fire-cracked rock 1

Square Meters Tested: 46 — Subsurface Artifacts: 13
Backhoe Trenches: 2 = 25 square meters





FB10413. *Top,* features; *bottom,* excavation areas.



FB10414. *Top,* features; *bottom,* excavation areas.

Historic Artifacts: 2 bottle fragments (A.D. 1890–1910)
Unique Artifacts: 1 unground piece of red ocher associated with Feature 1

Two block excavations and two backhoe trenches were excavated on this site. The largest block consisted of a 42-square-meter area in the southwest portion of the site over the burned caliche/fire-cracked rock feature. A 4-square-meter block was placed in the southeast portion of the site to test an area where a single utilized lithic flake was uncovered. The backhoe trenches were established in the southwest and the north-central portions of the site. No additional features or artifact concentrations were uncovered. Surface collections and excavations exhausted the research potential.

Feature No.	East	North	Type	Tested	Condition
1	90	105	Burned caliche	1	5

FB10415

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	2000 B.C.–A.D. 1150	Late Archaic to Mesilla phase

Size (meters): 2,162

Erosion: Severe   Modern Disturbance: Low

Surface Features:	0	Surface Artifacts:	5
Total Features:	0	Tested Features:	0

Feature Types: None

Square Meters Tested: 0   Subsurface Artifacts: 0

The surface artifacts were collected during Phase II. Initial assessments of the site indicated FB10415 was severely deflated and lacked prehistoric features, and the site was considered mitigated. The site was revisited during Phase III to verify the lack of research potential and no additional surface cultural evidence was noted. FB10415 is considered mitigated. All surface artifacts were collected, the surface is severely deflated, and the site lacks features.

FB10416

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

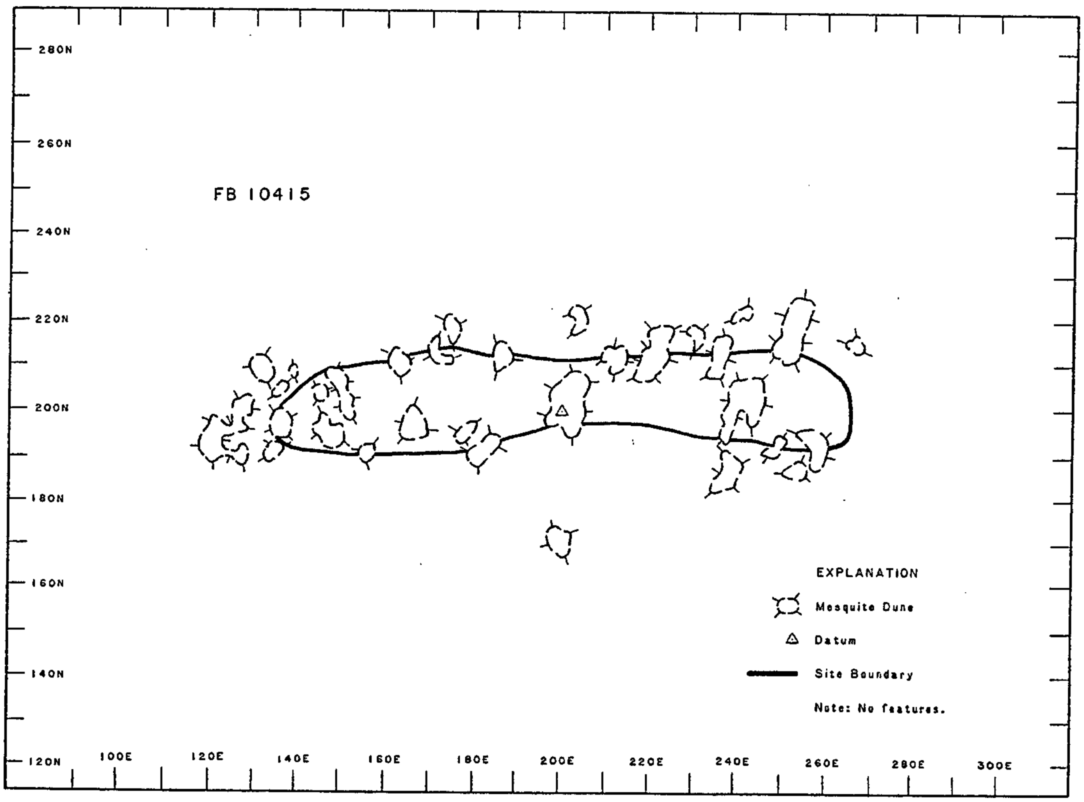
Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 285

Erosion: Moderate   Modern Disturbance: Low

Surface Features:	2	Surface Artifacts:	11
Total Features:	2	Tested Features:	2



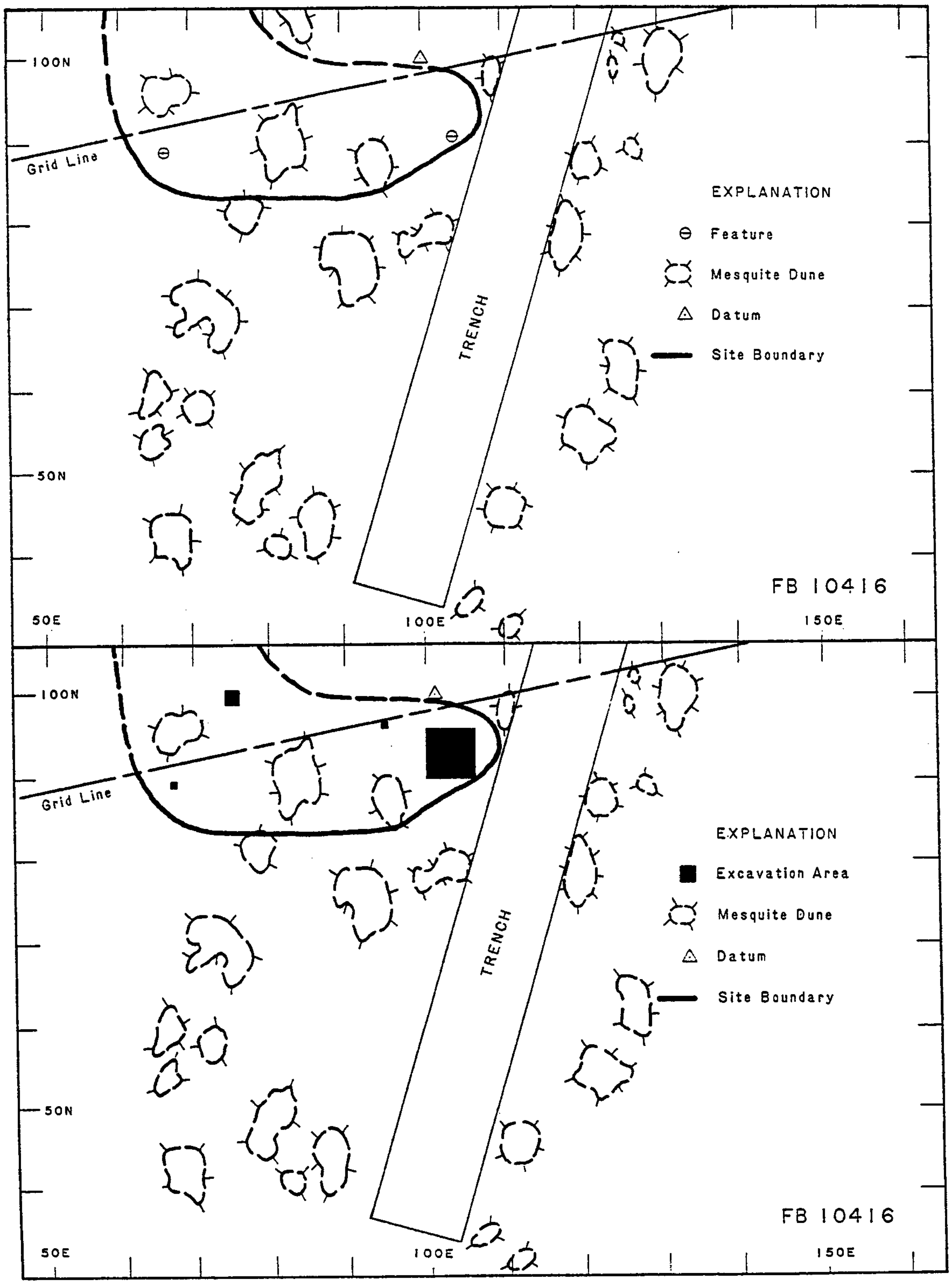
FB10415.

Feature Types:

Burned caliche/fire-cracked rock	1
Small stain	1

Square Meters Tested: 42 Subsurface Artifacts: 10
Backhoe Trenches: 1 = 12 square meters

Two block excavations, two 1-by-1 units, and a single backhoe trench were established to mitigate the potential for subsurface material. These excavations were within the site area that lies in northernmost grid quad. The largest block was a 36-square-meter area established in the southeast corner of the site over Feature 1. A 4-square-meter block was established in the west portion of the site where a single unifacially retouched lithic artifact was uncovered. A 1-by-1-meter unit was excavated to the northwest of the Feature 1 block. The other 1-by-1-meter unit was excavated over Feature 2. A single backhoe trench was placed north of Feature 1. A large tank trench that borders the eastern edge of the site provided data on subsurface soils.



FB10416. *Top,* features; *bottom,* excavation areas.

No additional features or artifact concentrations were uncovered. Subsurface material may be present in areas of the site outside the project boundaries that were not tested. Therefore, the entire site is not mitigated until excavations can be conducted in the adjacent grid quad.

Feature No.	East	North	Type	Tested	Condition
1	104	91	Burned caliche/fire-cracked rock	1	6
2	66	88	Small stain <1 meter	1	5

FB10417

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
EL Paso brownware ceramics	A.D. 250–1150	Mesilla phase

Size (meters): 1,967

Erosion: Moderate

Modern Disturbance: Low

Surface Features:	4	Surface Artifacts:	42
Total Features:	5	Tested Features:	4

Feature Types:

Burned caliche/fire-cracked rock	2
Small stain	3

Square Meters Tested: 68

Subsurface Artifacts: 88

The site was tested during Phase II of the project by three block excavation areas and a hand trench. The block excavation areas tested three identified surface features and the trench was excavated to determine subsurface densities of cultural materials in an area where a few surface artifacts were collected.

A 16-square-meter block was excavated over Feature 2 in the northwest portion of the site. Another 16-square-meter block was placed over Feature 4 in the southeastern portion of the site. Twelve square meters were excavated over Feature 1 in the central portion of the site. The trench excavation area was placed in the southeast portion of the site just to the southwest of the Feature 4 block. The trench was 1 by 8 meters west-to-east adjoined on the east edge by a 1 by 12 meter south-to-north trench.

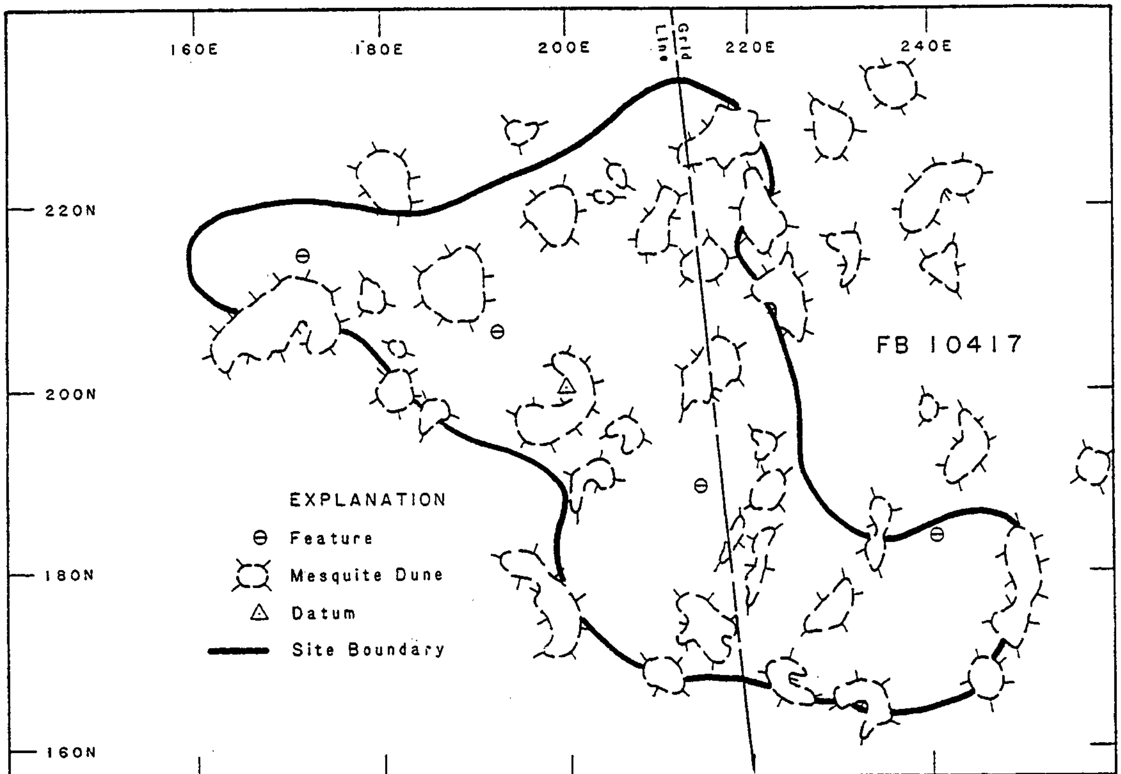
A single ash stain feature was uncovered in the trench excavations and all excavations contained a low density of subsurface cultural evidence. The testing results, the untested feature, and the moderate deflation suggests significant data still remain on this site.

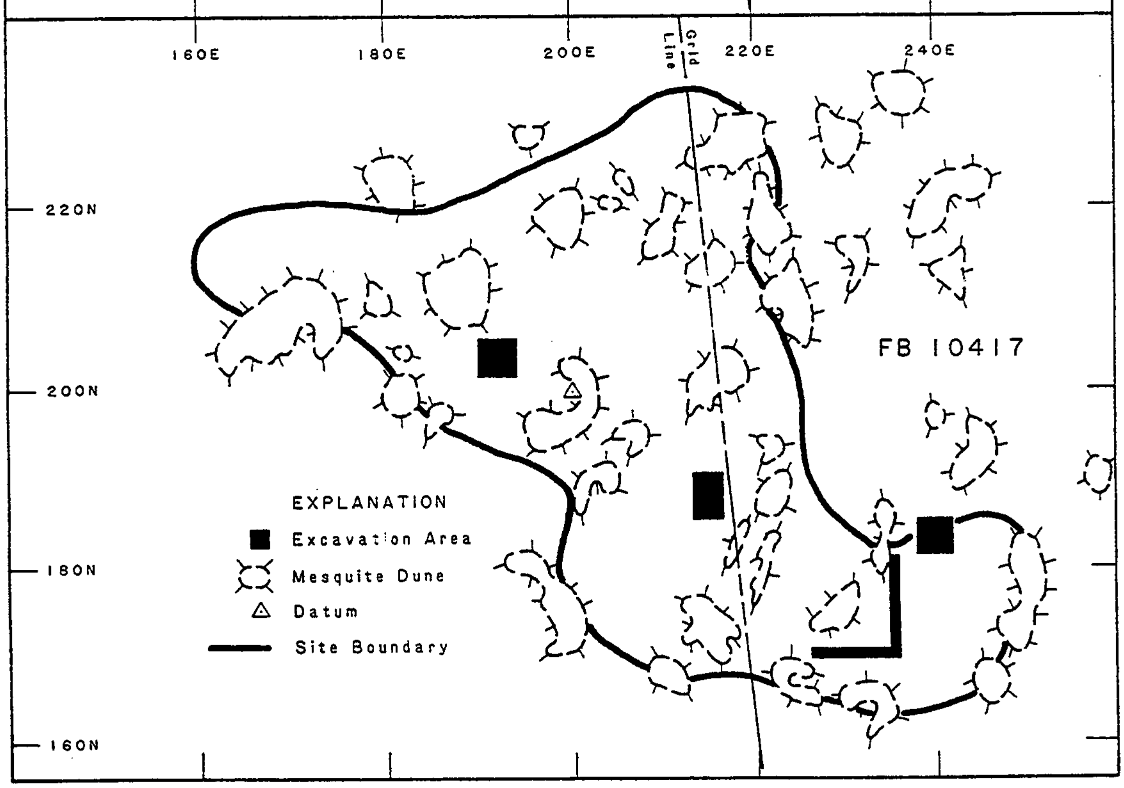
Feature No.	East	North	Type	Tested	Condition
1	216	191	Burned caliche/fire-cracked rock	Yes	5
2	193	206	Fire-cracked rock with stain	Yes	6
3	171	214	Small stain <1 meter	No	6
4	240	183	Small stain <1 meter	Yes	6

FB10418

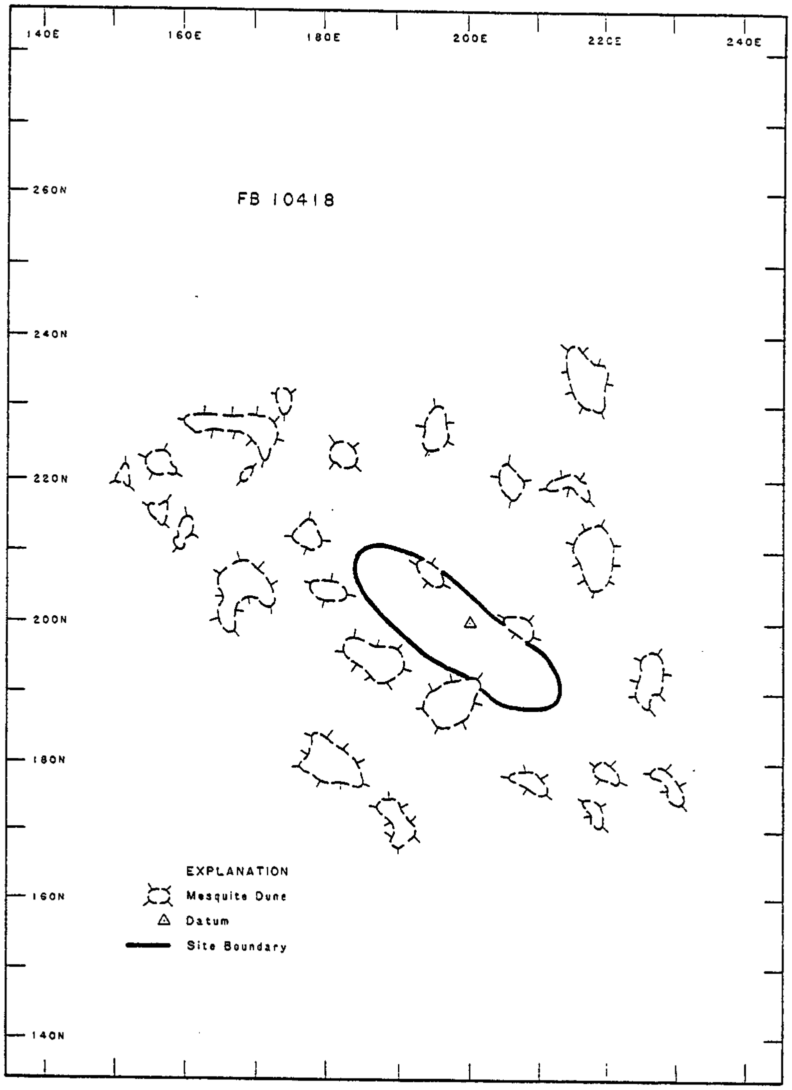
Status: 3 (no significant data remaining)

Radiocarbon Dates: None





FB10417. *Top,* features; *bottom,* excavation areas.



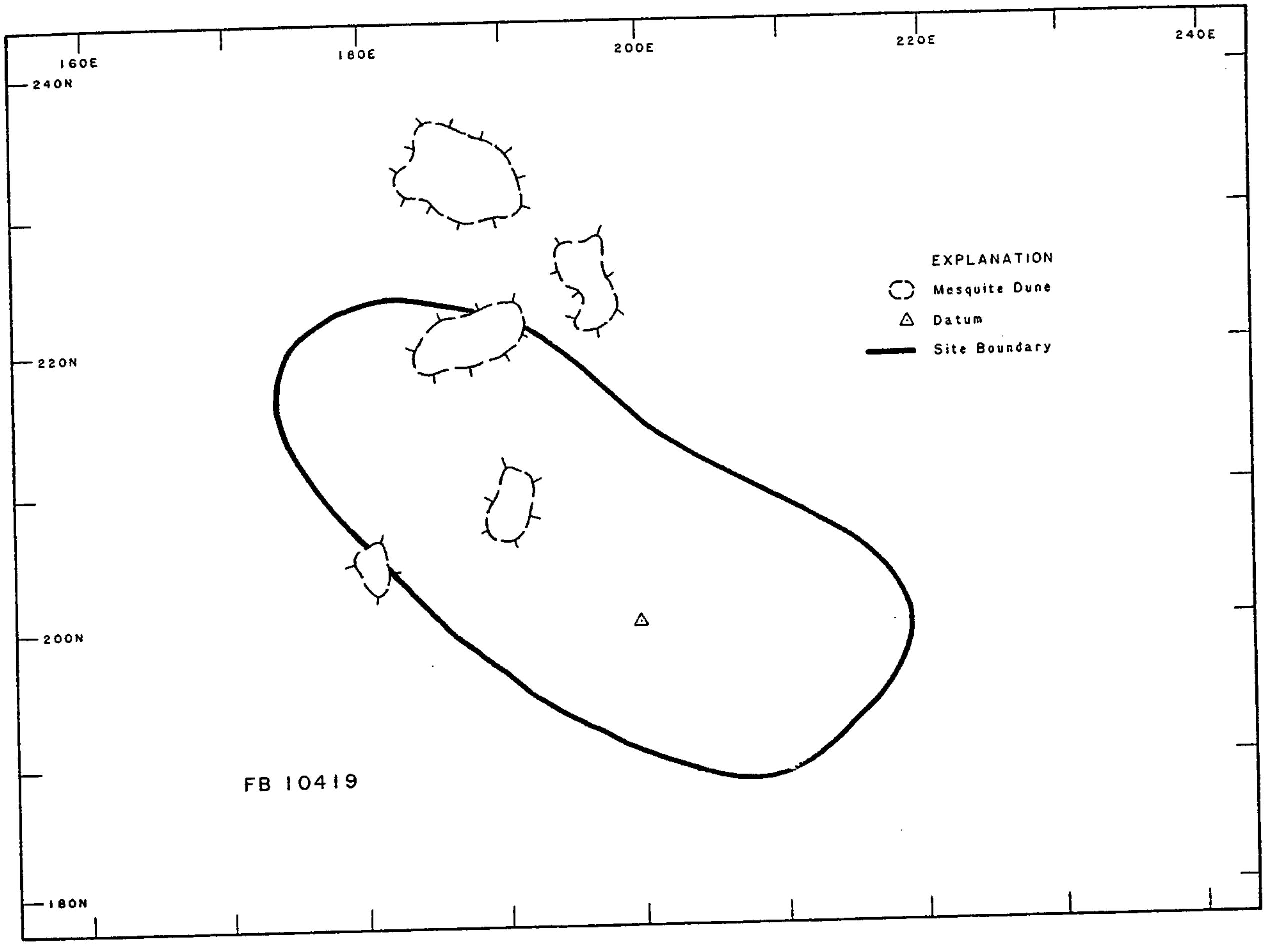
FB10418.

Diagnostic Artifacts: None

Size (meters): 210

Erosion:	Severe	Modern Disturbance:	Moderate
Surface Features:	0	Surface Artifacts:	2
Total Features:	0	Tested Features:	0
Feature Types: None			
Square Meters Tested: 0		Subsurface Artifacts: 0	

The surface artifacts of this site were collected during Phase II. Initial assessments of the site indicated the area was predominately severely deflated, moderately disturbed by modern activities, and lacked a prehistoric feature. These assessments in combination with the surface collections of all artifacts indicated the site was mitigated. The site was reexamined during Phase III of the project to verify these assessments. No additional cultural evidence was noted and all initial assessments were correct. FB10418 has no remaining research potential.



FB10419.

FB10419

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1,289

Erosion: Severe

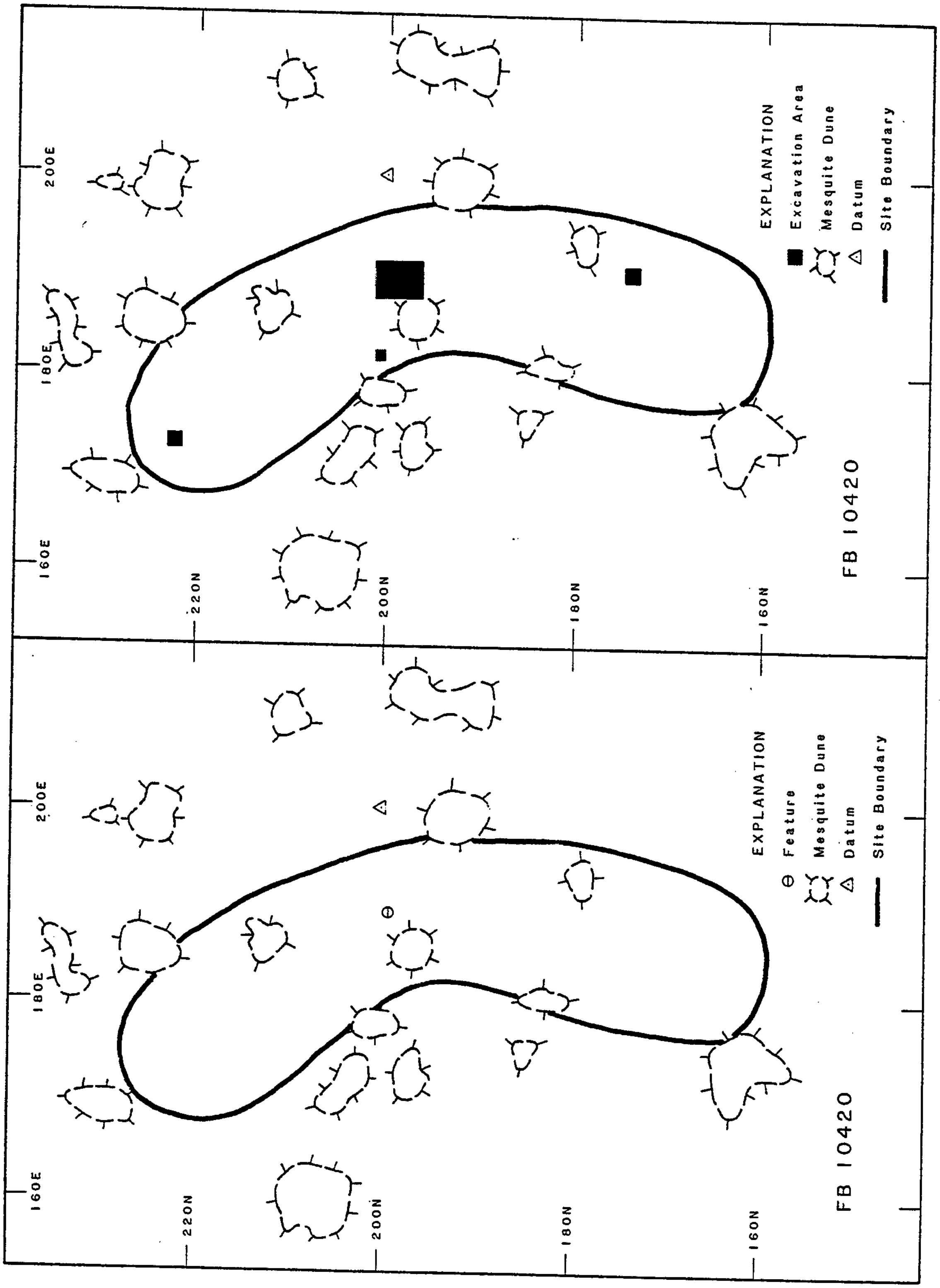
Modern Disturbance: Moderate

Surface Features: 0
Total Features: 0
Feature Types: None

Surface Artifacts: 1
Tested Features: 0

Square Meters Tested: 0

Subsurface Artifacts: 0



Site FB10420. *Left,* feature; *right,* excavation area.

The single surface artifact of this site was collected during Phase II of Project 90-11. Initial assessments indicated the site was extremely deflated, moderately disturbed by modern Army activities, and lacked a prehistoric feature. A few pieces of burned caliche and one piece of fire-cracked rock were also present, though they were well scattered and on deflated surfaces. The site was revisited during Phase III of the project to verify the initial assessments. A few new pieces of burned caliche were noted near the northeast site boundary, though as correctly assessed during Phase II of the project, the sites surface was severely deflated. The site has no additional research potential as the single artifact was collected, there are no features, and the site is deflated.

FB10420

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1,080

Erosion: Severe — Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	3
Total Features:	1	Tested Features:	1

Feature Types:

Fire-cracked rock	1

Square Meters Tested: 29 — Subsurface Artifacts: 2

Three block excavations and a single 1-by-1-square-meter unit were established on the site. The largest block excavation consisted of a 20-square-meter area over the only feature in the central portion of the site. A 4-square-meter area was placed in the south portion of the site over an area where a single lithic flake was collected. Another 4-square-meter area was excavated in the north portion of the site over another area where a lithic flake was uncovered. A single 1-by-1 was excavated west of the feature area.

No additional subsurface features were uncovered. The surface collections and excavations conducted on this site exhausted the research potential.

Feature No.	East	North	Type	Tested	Condition
1	188	201	Fire-cracked rock	1	5

FB11298

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 678

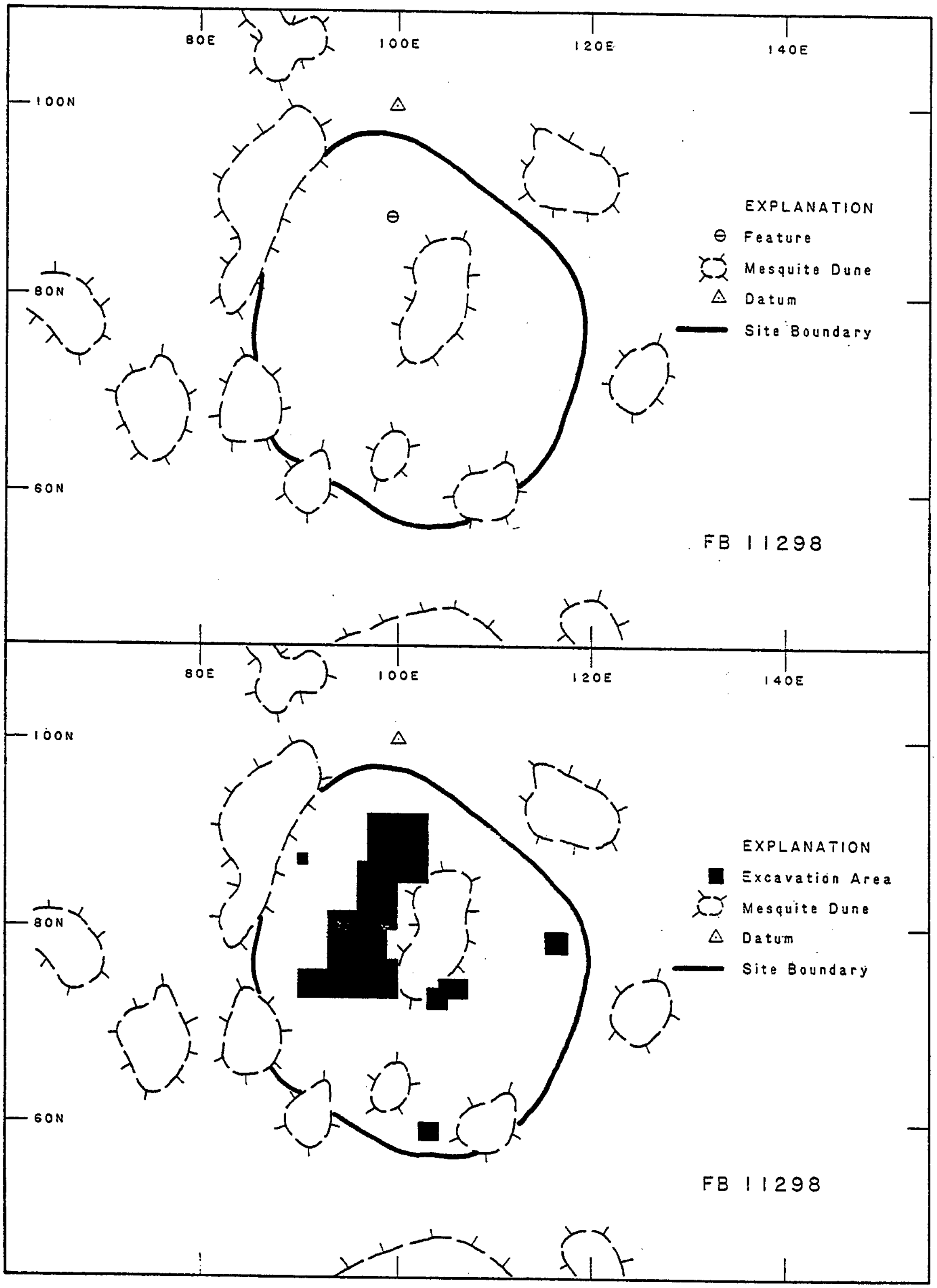
Erosion: Severe — Modern Disturbance: Severe

Surface Features:	1	Surface Artifacts:	13
Total Features:	3	Tested Features:	3

Feature Types:

Burned caliche/fire-cracked rock	3

Square Meters Tested: 143 — Subsurface Artifacts: 58



FB11298. *Top,* features; *bottom,* excavation areas.

Unique Artifacts: 1 unground piece of red ocher

Four block excavations and a single 1-by-1-meter unit were established on this site. The largest consisted of a 125-square-meter area that encompassed the majority of the central portion of the site. This excavation area was initially established to excavate the only feature identified on the surface. This excavation area was then expanded to the south because of subsurface recovery rates of cultural materials and the discovery of two additional features. A 9-square-meter block was excavated to the southeast of the later excavation where a few surface ground stone fire-cracked rock pieces were uncovered. A 4-square-meter block was excavated against the east edge of the site where a single lithic flake was uncovered. Another 4-meter block was placed against the south edge of the site where a single ground stone fire-cracked rock was found. The 1-by-1-meter unit was in the northwest portion of the site on the east leading edge of a mesquite dune.

The excavations revealed subsurface material throughout the largest excavation block along with two additional features. Given these results, the site requires additional work for evaluation.

Feature No.	East	North	Type	Tested	Condition
1	100	92	Burned caliche/fire-cracked rock	1	3

FB11299

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
47940	9	810 ± 50	A.D. 1045 –1275	Mesilla phase–El Paso phase
47941	9	860 ± 50		

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-39	243	164	0	2.65	El Paso phase/Mesilla phase
DL-92-420	246	162	0	2.76	El Paso phase/Mesilla phase
DL-92-421	227	169	1	3.88	Mesilla phase
DL-92-422	248	159	0	2.56	El Paso phase/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
El Paso Brown rim	A.D. 250–1150	Mesilla phase

Size (meters): 5,509

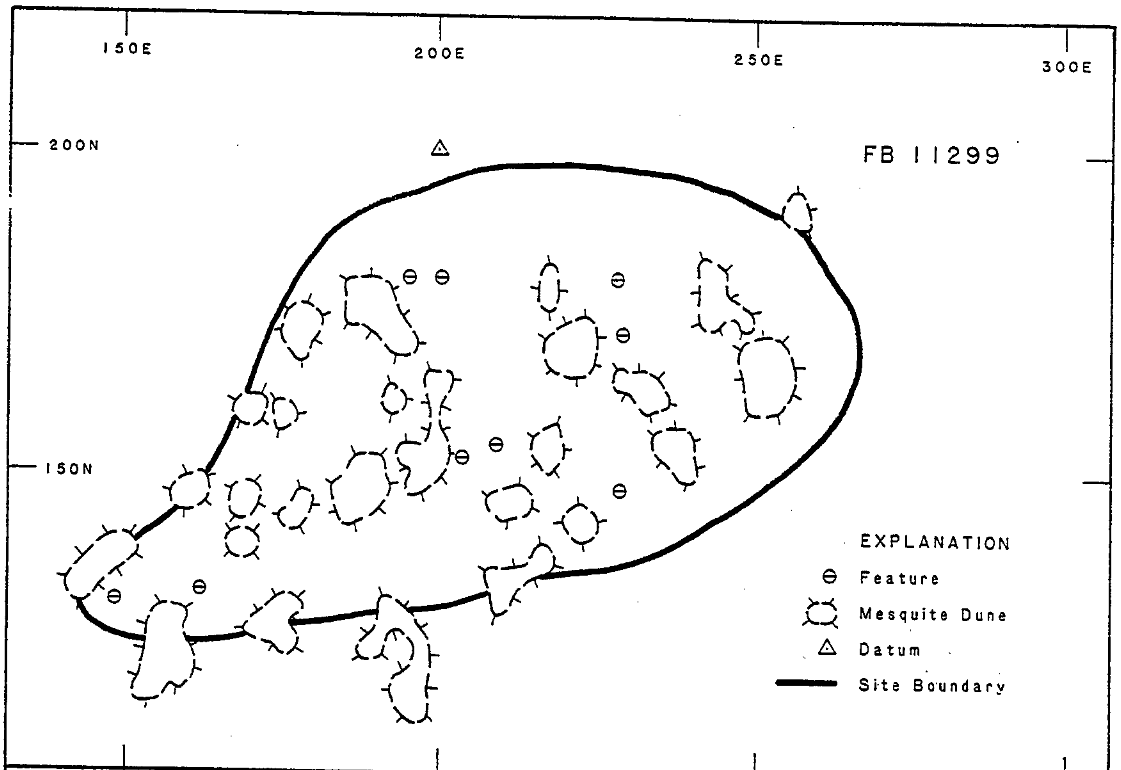
Erosion:	Moderate	Modern Disturbance:	Low
Surface Features:	9	Surface Artifacts:	35
Total Features:	9	Tested Features:	1

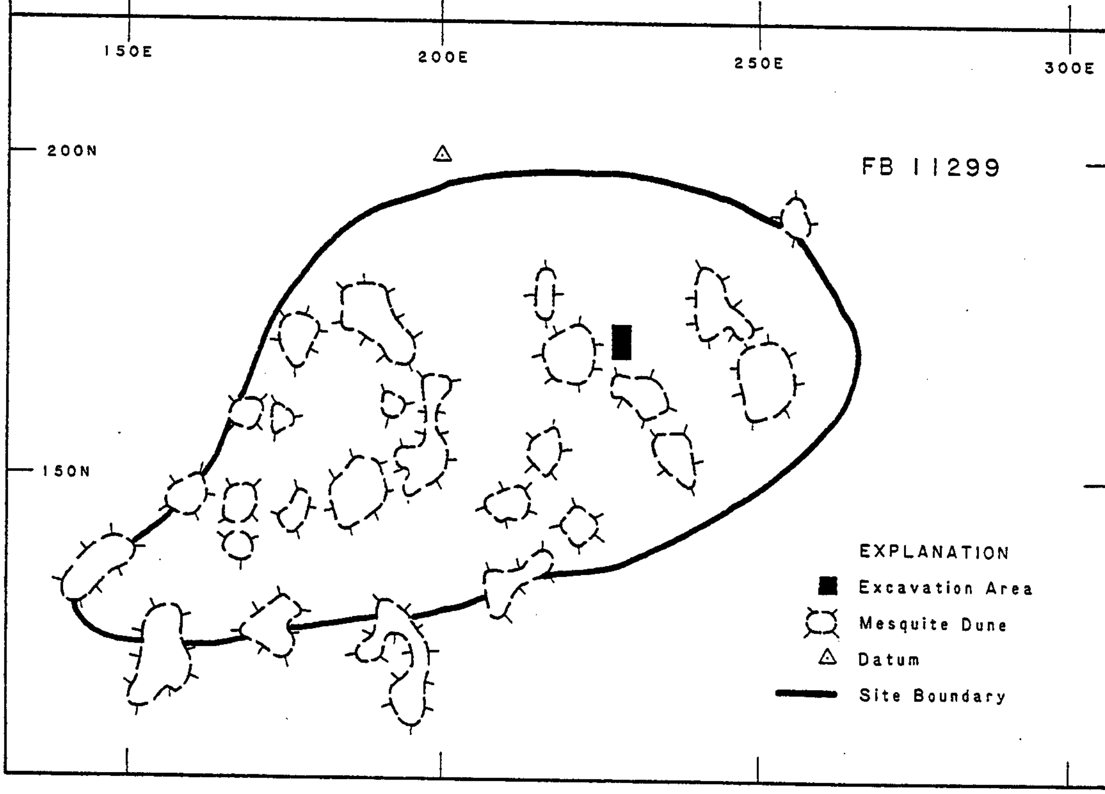
Feature Types:

Burned caliche	4
Burned caliche/fire-cracked rock	3
Small stain	2

Square Meters Tested: 15 Subsurface Artifacts: 2

The site was tested during Phase III of the project with a single block excavation that consisted of a 15-square-meter area over Feature 9 in the east-central portion of the site. Additional surface artifacts were





FB11299. *Top,* features; *bottom,* excavation areas.

collected during Phase III indicating subsurface cultural materials were being exposed. The block excavation area contained a low density of subsurface cultural materials and did not exhaust the research potential.

FB11299 still contains significant data given subsurface material being exposed. Eight surface features remain untested, and the surface of the site area is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	148	129	Burned caliche	No	4
2	161	131	Burned caliche	No	3
3	203	152	Burned caliche	No	5
4	210	155	Burned caliche/fire-cracked rock	No	4
5	195	180	Burned caliche/fire-cracked rock	No	5
6	200	180	Burned caliche	No	4
7	228	148	Burned caliche/fire-cracked rock	No	4
8	227	180	Small stain <1 meter	No	5
9	228	172	Small stain <1 meter	Yes	4

FB12017

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 403

Erosion: Moderate

Modern Disturbance: Moderate

Surface Features:	1	Surface Artifacts:	5
Total Features:	1	Tested Features:	1

Feature Types:

Burned caliche/fire-cracked rock	1

Square Meters Tested: 42

Subsurface Artifacts: 18

Four block excavations were established on this site. The largest consisted of a 30-square-meter area placed over the only surface feature of the site. Three 4-square-meter blocks completed the remaining excavations on this site. These were placed in the southeast, southwest, and north portions to test where surface lithic artifacts were found and to test built-up interdunal sands between two large mesquites north of the feature.

Additional artifacts were collected from the surface during Phase III, indicating subsurface material eroded out of buried soils. Block excavations revealed subsurface cultural materials and did not exhaust the subsurface extent of these materials.

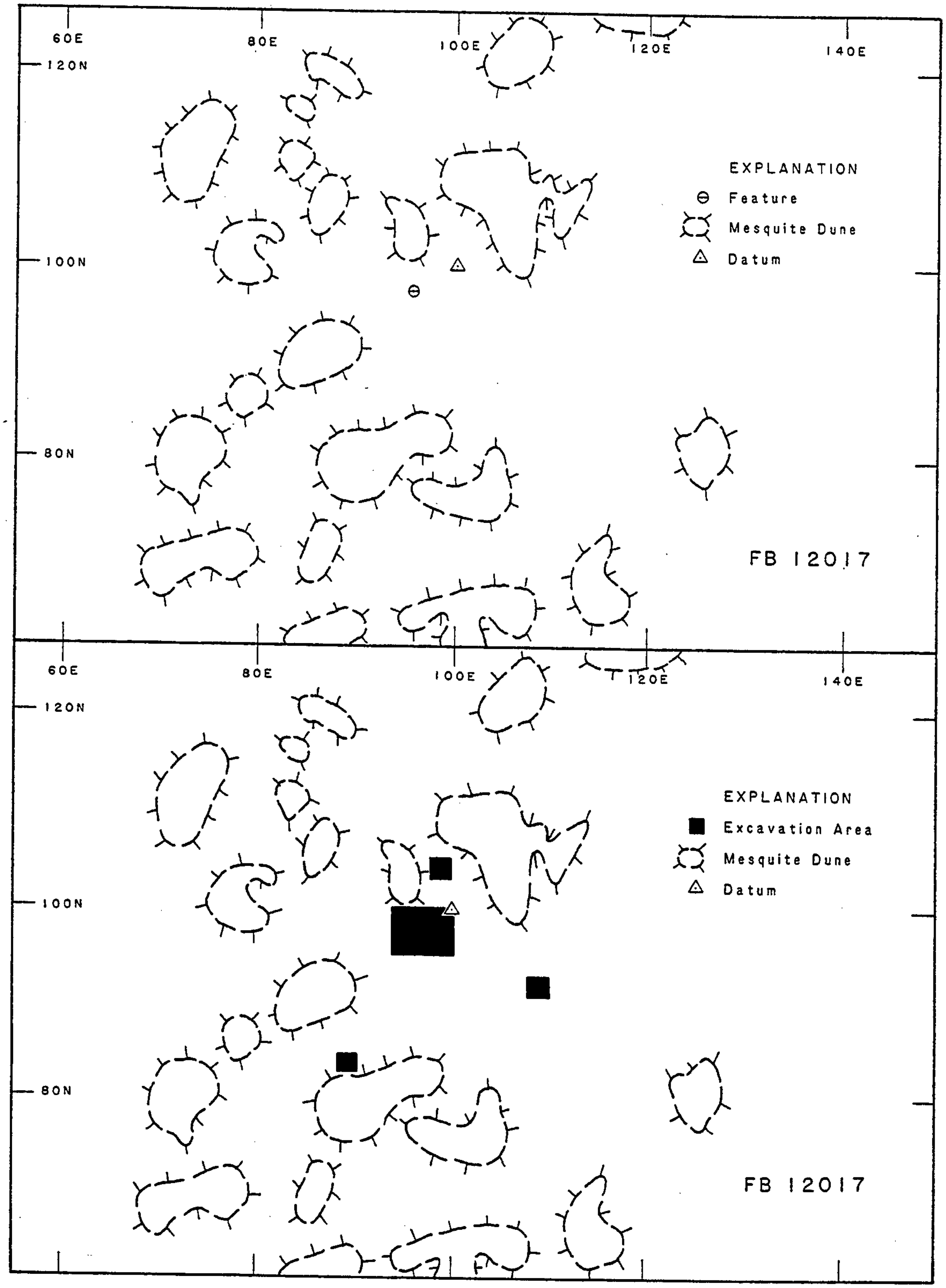
FB12017 is not mitigated. The recovery of an artifact concentration in the southeast 4-square-meter block, the presence of cultural materials in the northern 4-square-meter block, and the presence of dunal sands between nearby sites, suggest subsurface cultural material may exist immediately around and within FB12017.

Feature No.	East	North	Type	Tested	Condition
1	95	97	Burned caliche/fire-cracked rock/stain	1	3

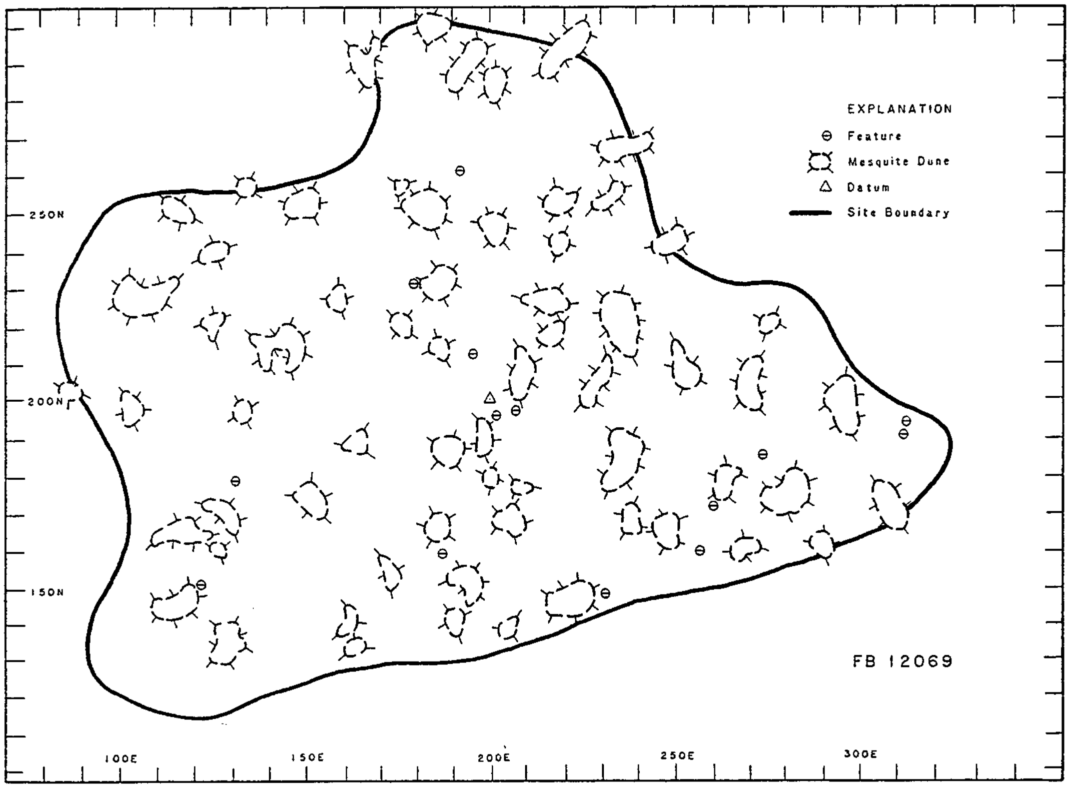
FB12069

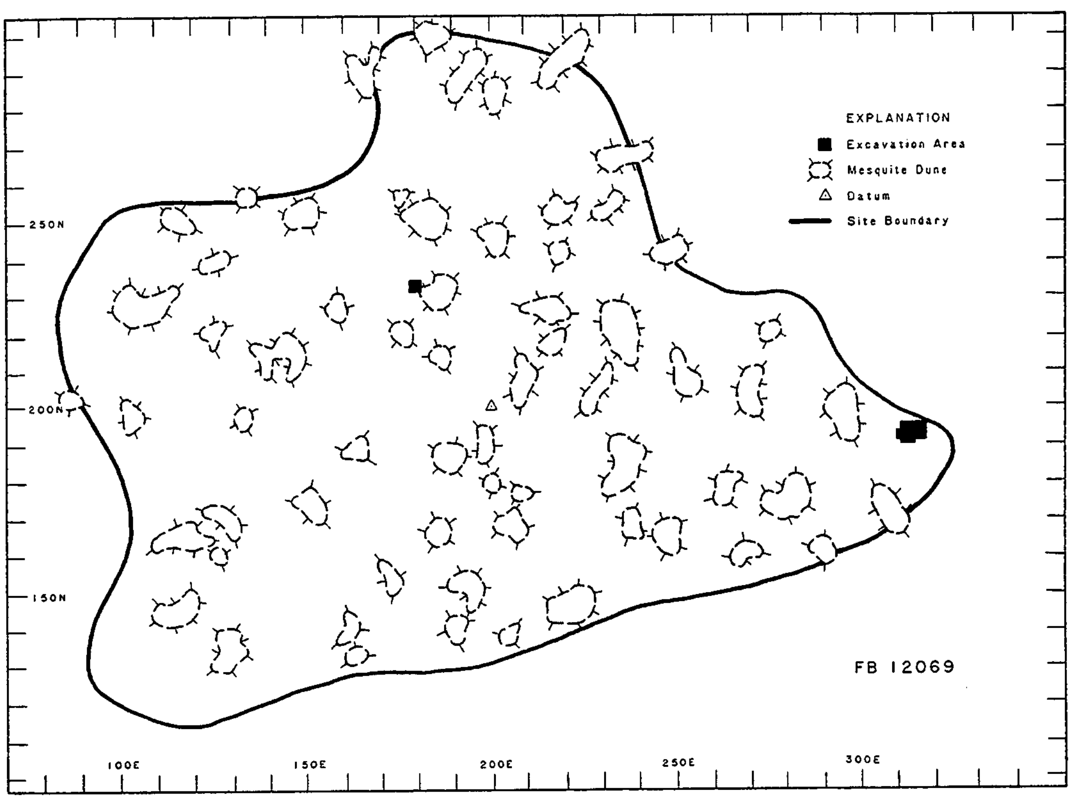
Status: 1 (significant data remaining)

Radiocarbon Dates:



FB12017. *Top,* features; *bottom,* excavation areas.





FB12069. *Top,* features; *bottom,* excavation areas.

Beta #	Feature #	Date	Corrected Date	Time Period
43203	7	1510 ± 70	A.D. 410–660	Mesilla phase
43204	15	1490 ± 50	A.D. 430–650	Mesilla phase
47942	16	1460 ± 70	A.D. 410–558	Mesilla phase
47943	16	1540 ± 60		
50097	16	1720 ± 60		
50098	16	1550 ± 50		
50095	16	1390 ± 70	A.D. 540–770	Mesilla phase
50096	18	1600 ± 60	A.D. 260–597	Mesilla phase

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-398	268	195	0	5.24	Late Archaic/Mesilla phase
DL-92-399	280	196	0	–	–
DL-92-400	272	197	0	5.84	Late Archaic
				3.93	Mesilla phase
DL-92-401	149	132	0	7.07	Late Archaic
				5.38	Late Archaic/Mesilla phase

Diagnostic Artifacts: None

Size (meters): 25,724

Erosion: Moderate

Modern Disturbance: Low

Surface Features: 14

Total Features: 24

Surface Artifacts: 156

Tested Features: 12

Feature Types:

Burned caliche	6
Fire-cracked rock	1
Burned caliche/fire-cracked rock	5
Small stain	11
Large stain	1

Square Meters Tested: 51

Subsurface Artifacts: 136

FB12069 was tested with two block excavation areas. The largest consisted of a 42-square-meter area in the extreme southeast corner of the site over Feature 15 and 16. The other block consisted of a 9-square-meter area in the north-central portion of the site over Feature 7.

Testing revealed subsurface cultural materials from both block excavations. The research potential of cultural evidence was not exhausted with either of the blocks. The largest block excavation area also uncovered 10 subsurface features of which 3 were not directly associated with Feature 15 or 16.

FB12069 still contains significant data given the excavation results, numerous features, and areas of the site that remain untested. The site surface is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	257	159	Burned caliche	No	4
2	274	184	Burned caliche/fire-cracked rock	No	4
3	231	147	Burned caliche/fire-cracked rock	No	4
4	187	159	Burned caliche/fire-cracked rock	No	4
5	195	212	Burned caliche/fire-cracked rock	No	5
6	191	260	Burned caliche	No	4

7	179	231	Burned caliche with stain	Yes	7
8	131	179	Fire-cracked rock	No	3
9	207	196	Burned caliche	No	3
10	202	196	Burned caliche/fire-cracked rock	No	4
11	260	171	Small stain <1 meter	No	5
12	122	150	Small stain <1 meter	No	5
14	312	190	Burned caliche	Yes	5
15	313	193	Small stain <1 meter	Yes	6

FB12072

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43205	6	1930 ± 50	A.D. 75–316	Late Archaic/Mesilla phase
50099	6	1640 ± 50		
53364	6	1930 ± 50		
43206	17	1920 ± 40	87 B.C.– A.D.210	Late Archaic
43207	15	2040 ± 80	A.D. 26–212	Late Archaic
43208	15	2020 ± 90		
50100	15	1920 ± 60		
53366	15	1870 ± 50		
53367	15	1790 ± 60		
43209	12	270 ± 70	A.D. 1450–1955	Protohistoric to Historic
50101	20	1890 ± 60	88 B.C.– A.D.130	Late Archaic
50102	20	1890 ± 50		
53365	20	1910 ± 70		

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-402	433	406	0	2.59	El Paso phase/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

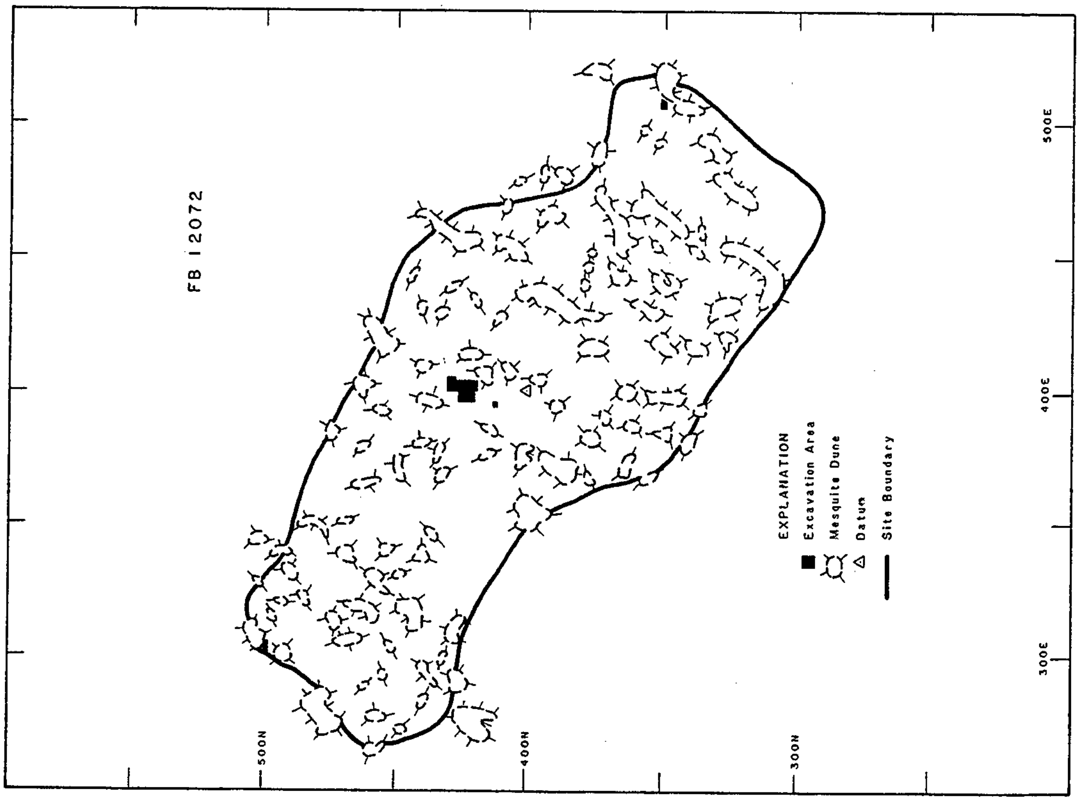
Size (meters): 22,876

Erosion: Moderate   Modern Disturbance: Low

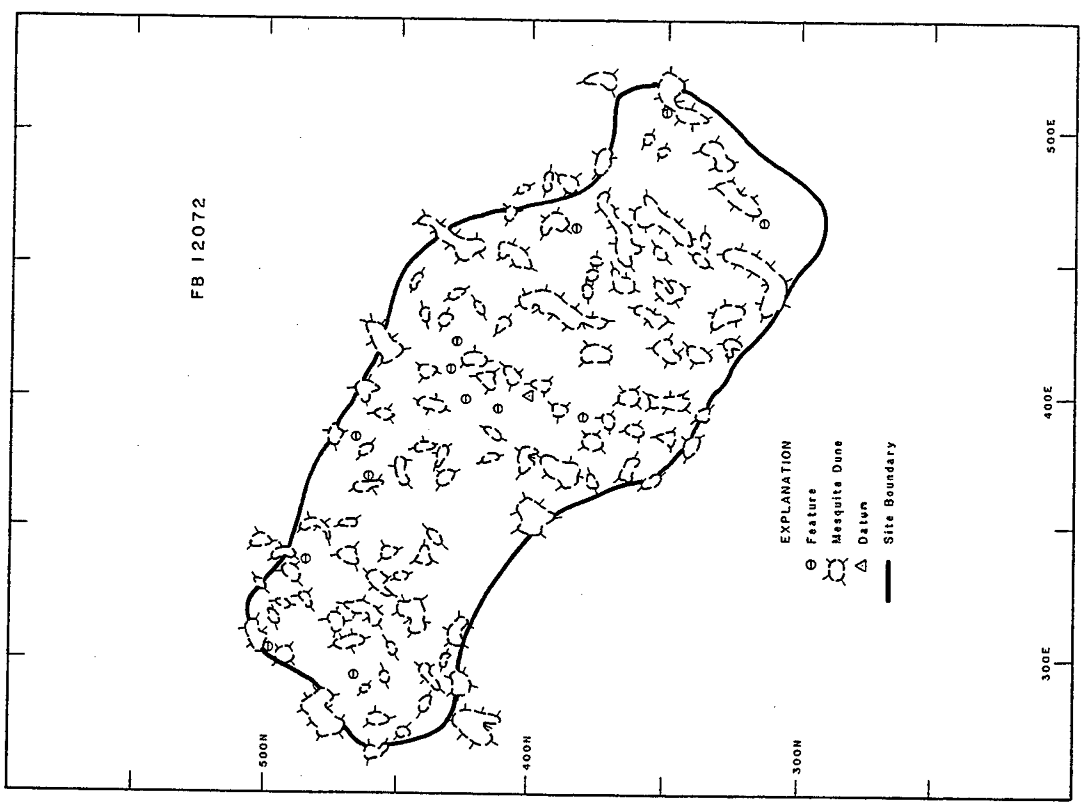
Surface Features: 14   Surface Artifacts: 55
Total Features: 23   Tested Features: 12
Feature Types:

Burned caliche	4
Fire-cracked rock	2
Burned caliche/fire-cracked rock	1
Small stain	15
Large stain	1

Square Meters Tested: 88   Subsurface Artifacts: 20



FB12072 Excavation Areas.



FB12072 Features.

FB 12072 was tested in four block excavations. The largest was a 71-square-meter area in the central portion of the site over Features 6 and 15. An 8-square-meter block excavation was placed in the northwest corner of the site over Feature 11. Five square meters were against the southeast corner of the site over Feature 12. Four square meters were in the central portion of the site, south of the Feature 6 block over Feature 7.

Additional surface artifacts noted on the surface during Phase III were not collected. These additional artifacts indicate cultural materials are being exposed. Block excavation areas contained subsurface cultural materials. A total of six subsurface features were uncovered in the largest block excavation. The horizontal extent of subsurface material was not exhausted within any of the block excavations.

FB12072 still contains significant data given the testing results. Cultural evidence is being exposed, numerous features and certain areas of the site remain untested, and the surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	295	468	Burned caliche	No	3
2	338	483	Burned caliche/fire-cracked rock	No	4
3	370	460	Fire-cracked rock	No	3
4	384	465	Small stain <1 meter	No	5
5	470	428	Small stain <1 meter	No	5
6	398	425	Small stain <1 meter	Yes	6
7	395	412	Small stain <1 meter	Yes	4
8	392	380	Burned caliche	No	4
9	466	314	Fire-cracked rock	No	3
10	410	430	Burned caliche with stain	No	6
11	305	497	Small stain <1 meter	Yes	6
12	507	350	Burned caliche	Yes	7
13	464	384	Small stain <1 meter	No	5
14	430	414	Small stain <1 meter	No	4

FB12090

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 204

Erosion: Moderate | Modern Disturbance: Low

Surface Features: 0 | Surface Artifacts: 3
Total Features: 0 | Tested Features: 0
Feature Types: None

Square Meters Tested: 0 | Subsurface Artifacts: 0

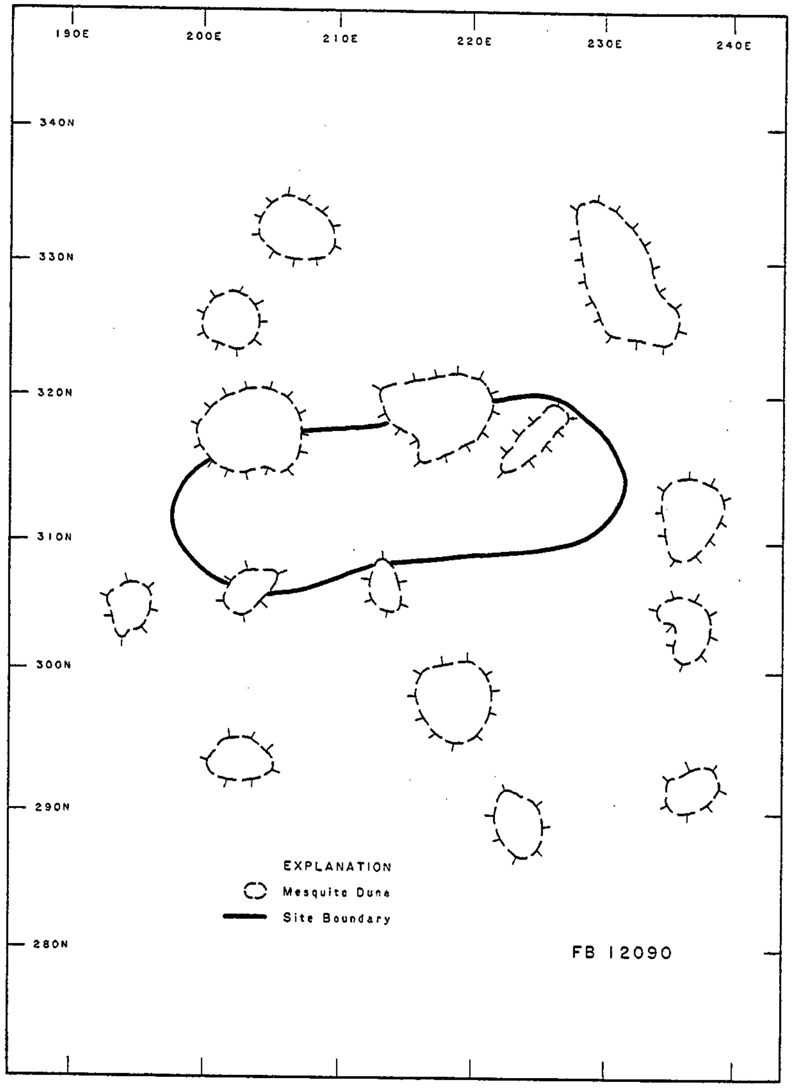
No testing for subsurface material was undertaken. The site lacked features, and the collection of three items from the surface exhausted the research potential of this site.

FB12091 (41EP4906)

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None



FB12090.

Size (meters): 570

Erosion: Low

Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	10
Total Features:	1	Tested Features:	0
Feature Types:			

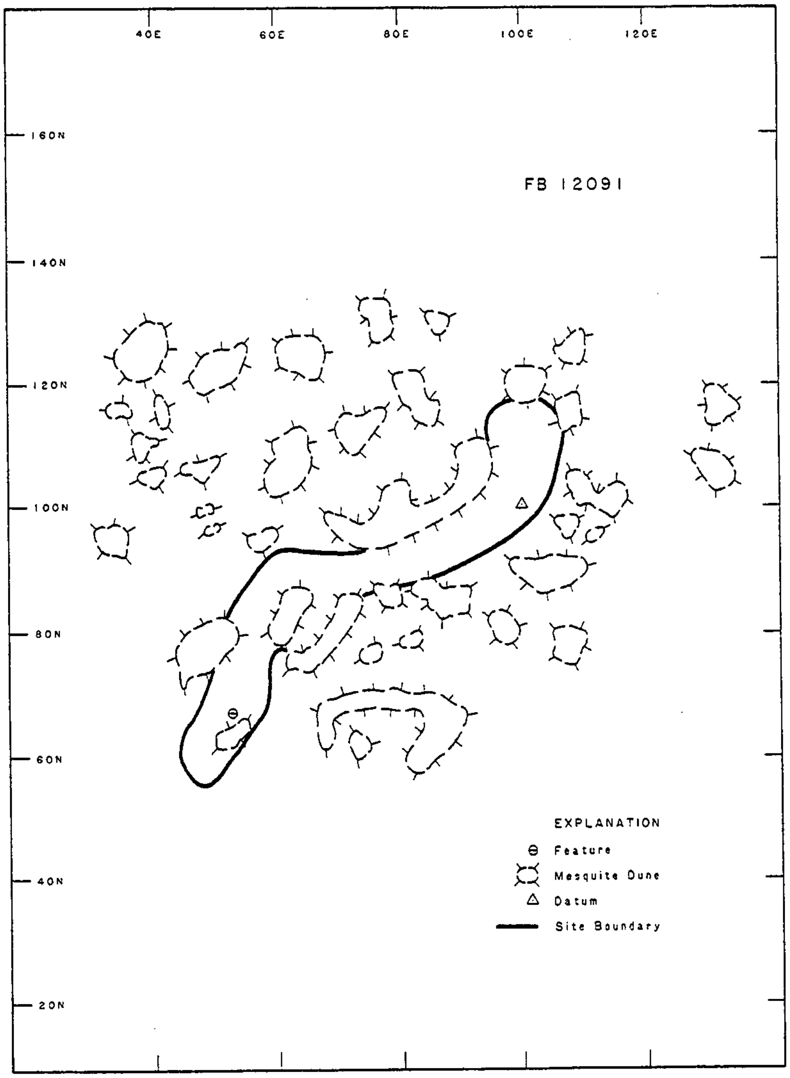
Burned caliche 1

Square Meters Tested: 0

Subsurface Artifacts: 0

All surface artifacts of FB12091 were collected during Phase II of the project. FB12091 may still contain significant data. No testing of the site area was conducted. The surface of the site is only minimally deflated. Additional testing is required to determine the status of the site.

Feature No.	East	North	Type	Tested	Condition
1	55	67	Burned caliche	0	4



FB12091 (41EP4906).

FB12092

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

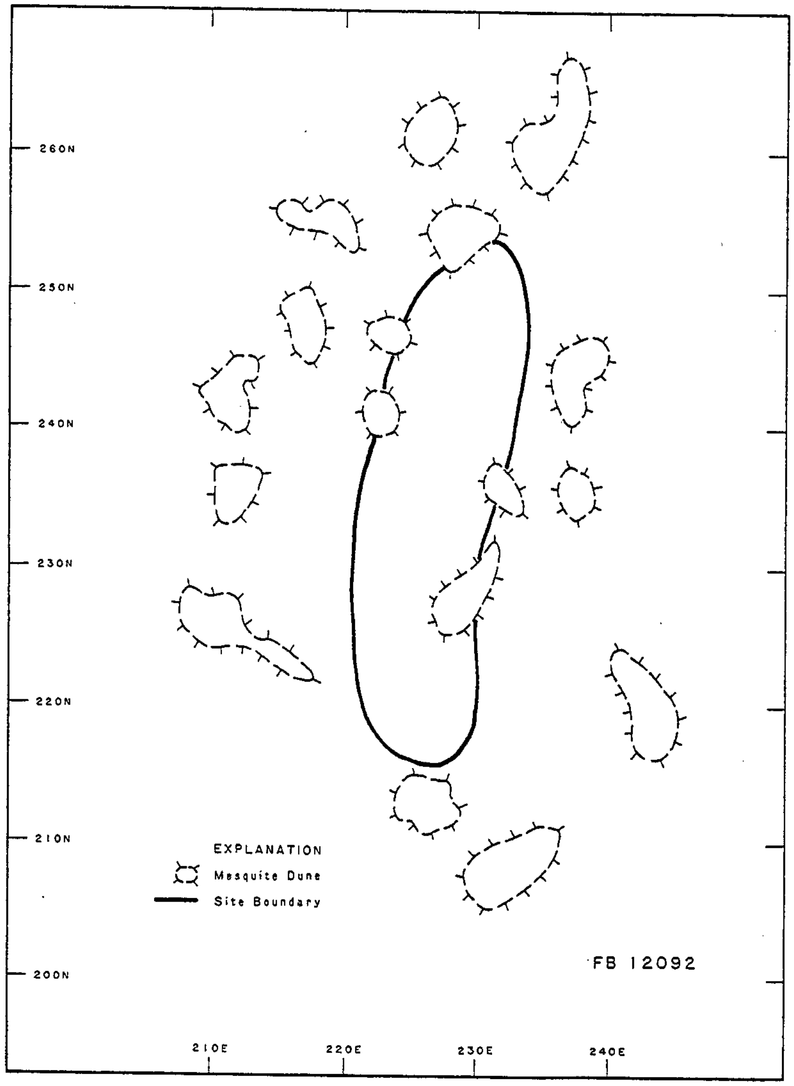
Artifact Type	Probable Date	Time Period
Projectile point	10,000–6000 B.C.	Paleoindian period

Size (meters): 280

Erosion: Moderate — Modern Disturbance: Low

Surface Features:	0	Surface Artifacts:	2
Total Features:	0	Tested Features:	0

Feature Types: None



FB12092.

Square Meters Tested: 0

Subsurface Artifacts: 0

No testing for subsurface material was undertaken on this site. Three items were on the surface; two were artifacts and they were collected. The remaining item was an isolated piece of burned caliche. Collection of the surface artifacts exhausted the research potential of the site.

FB12093

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

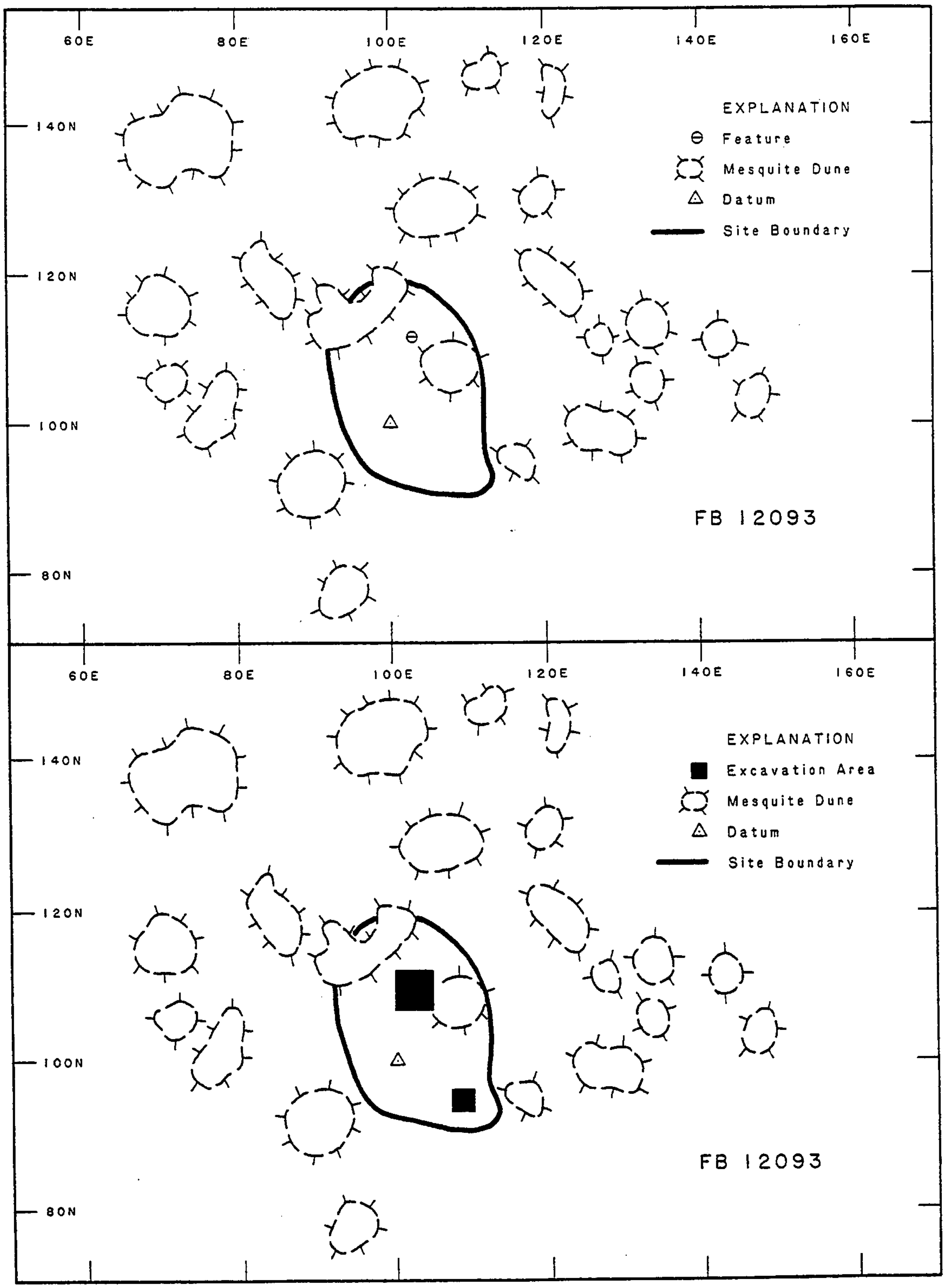
Size (meters): 430

Erosion: Low

Modern Disturbance: Moderate

Surface Features: 1

Surface Artifacts: 1



FB12093. *Top,* feature; *bottom,* excavation areas.

Total Features: 1 Tested Features: 1
Feature Types:

Burned caliche 1

Square Meters Tested: 34 Subsurface Artifacts: 2

Two block excavations were established on this site. The largest block consisted of a 25-square-meter area placed over the only feature. Nine square meters were established over the only artifact found on the surface of this site. The largest block excavation uncovered few subsurface artifacts and the smaller block had no subsurface material.

No subsurface features were revealed and no subsurface artifact concentrations were uncovered. The surface collections and excavations conducted on this site exhausted the research potential on this site.

Feature No.	East	North	Type	Tested	Condition
1	103	112	Burned caliche	1	5

FB12095 (41EP4907)

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 114

Erosion: Severe Modern Disturbance: None

Surface Features: 1 Surface Artifacts: 0
Total Features: 1 Tested Features: 1
Feature Types:

Burned caliche 1

Square Meters Tested: 23 Subsurface Artifacts: 3
Auger Holes: 8

One block excavation and eight auger holes were established on this site. The block excavation was a 23-square-meter area placed over Feature 1, which was the entire site. The auger holes were excavated within and around the block. Block excavation exhausted the horizontal extent of subsurface material, and the auger holes revealed no cultural evidence.

FB12095 was visited during Phase III of the project to verify the lack of cultural materials. None were noted during this visit and the site has no remaining research potential.

Feature No.	East	North	Type	Tested	Condition
1	99	112	Burned caliche	1	2

FB12096

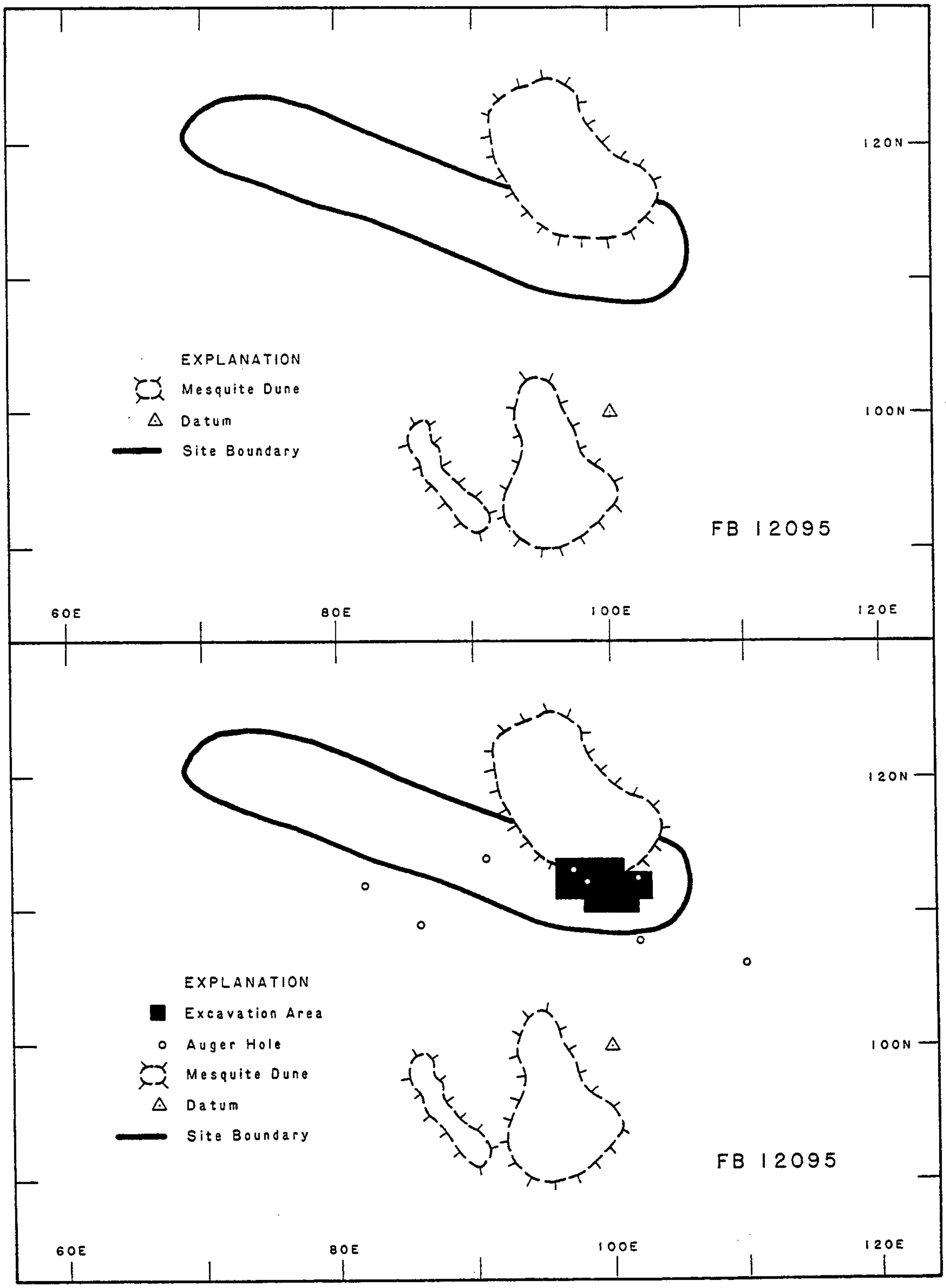
Status: 1 (significant data remaining)

Radiocarbon Dates: None

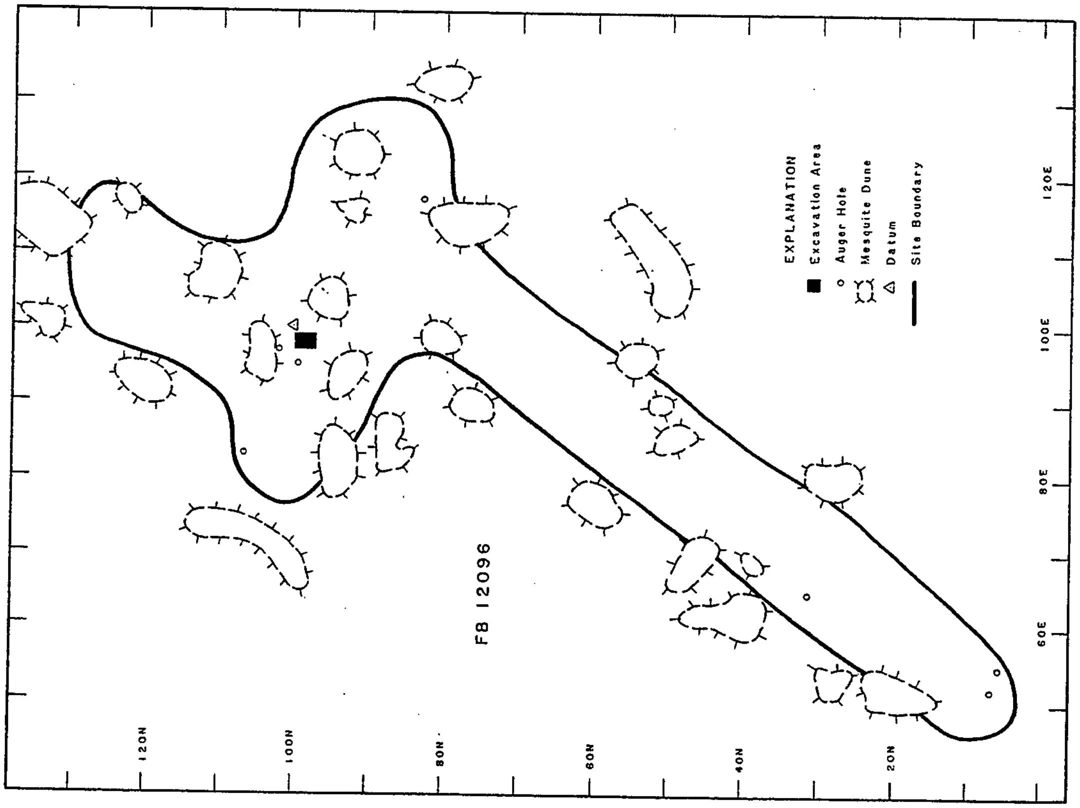
Diagnostic Artifacts: None

Size (meters): 2,801

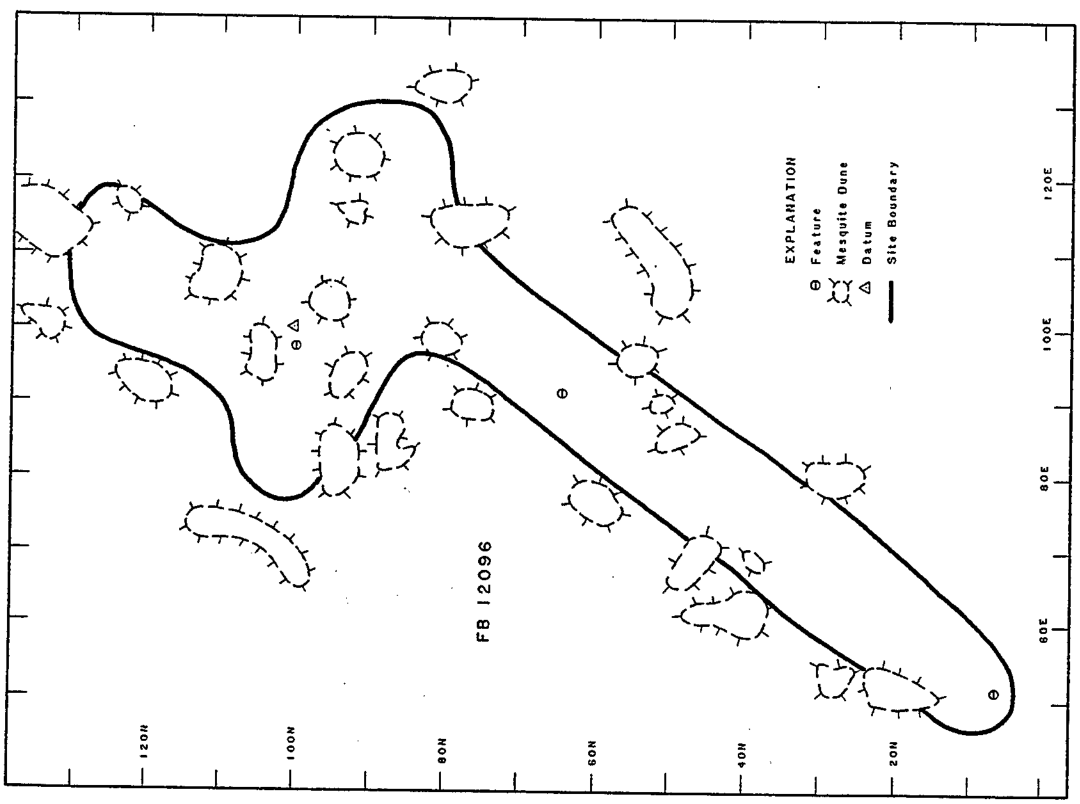
Erosion: Low Modern Disturbance: Low



FB12095 (41EP4907). *Top,* feature; *bottom,* excavation area.



FB12096 Excavation Areas.



FB12096 Features.

Surface Features:	3	Surface Artifacts:	10
Total Features:	3	Tested Features:	1

Feature Types:

Fire-cracked rock	1
Burned caliche/fire-cracked rock	2

Square Meters Tested: 6 Subsurface Artifacts: 2

The site was tested with one block excavation over Feature 1. This block excavation area was placed in the north portion of the site and consisted of a 6-square-meter area. Testing uncovered a few subsurface cultural materials. This excavation did not exhaust the subsurface horizontal extent of cultural evidence.

The site still contains significant data given the excavation results. Not all surface features were tested, large portions of the site area remain untested, and the surface of the site is only partially deflated.

Feature No.	East	North	Type	Tested	Condition
1	97	100	Burned caliche/fire-cracked rock	1	5
2	92	65	Burned caliche/fire-cracked rock	0	6
3	51	6	Fire-cracked rock	0	1

FB12097

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	4000 B.C.–A.D. 250	Middle to Late Archaic

Size (meters): 2,781

Erosion: Low Modern Disturbance: Moderate

Surface Features:	3	Surface Artifacts:	3
Total Features:	3	Tested Features:	3

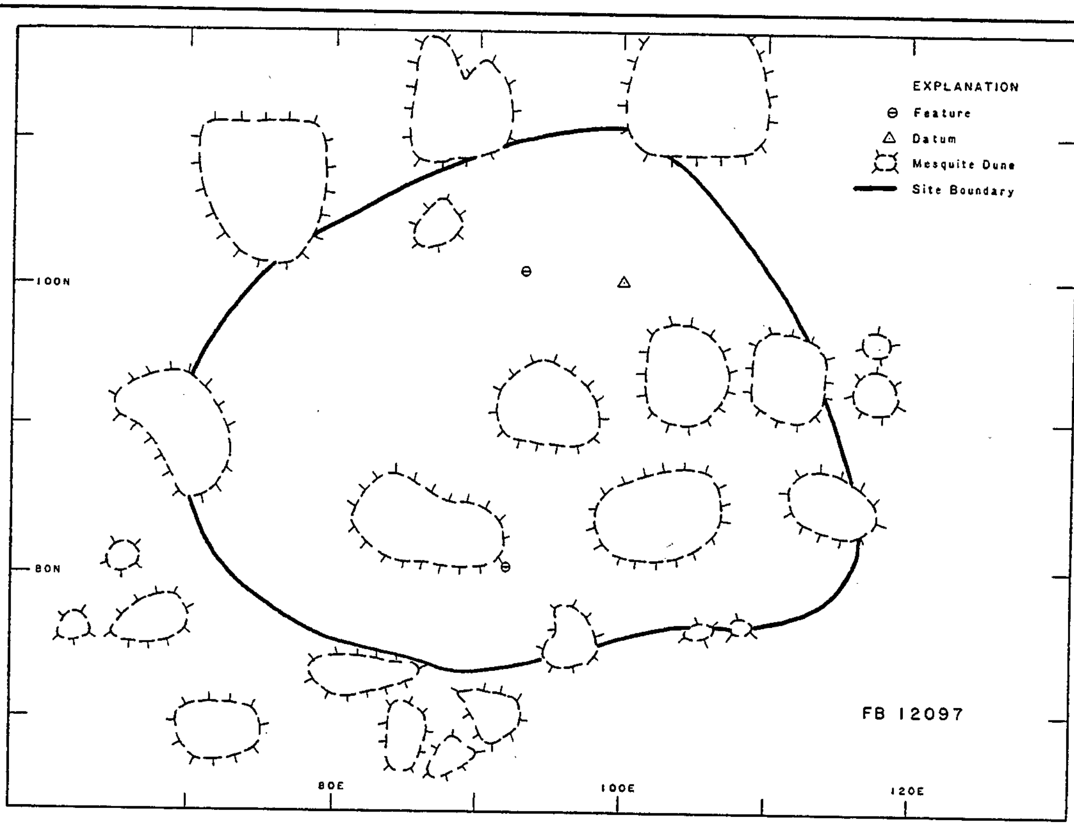
Feature Types:

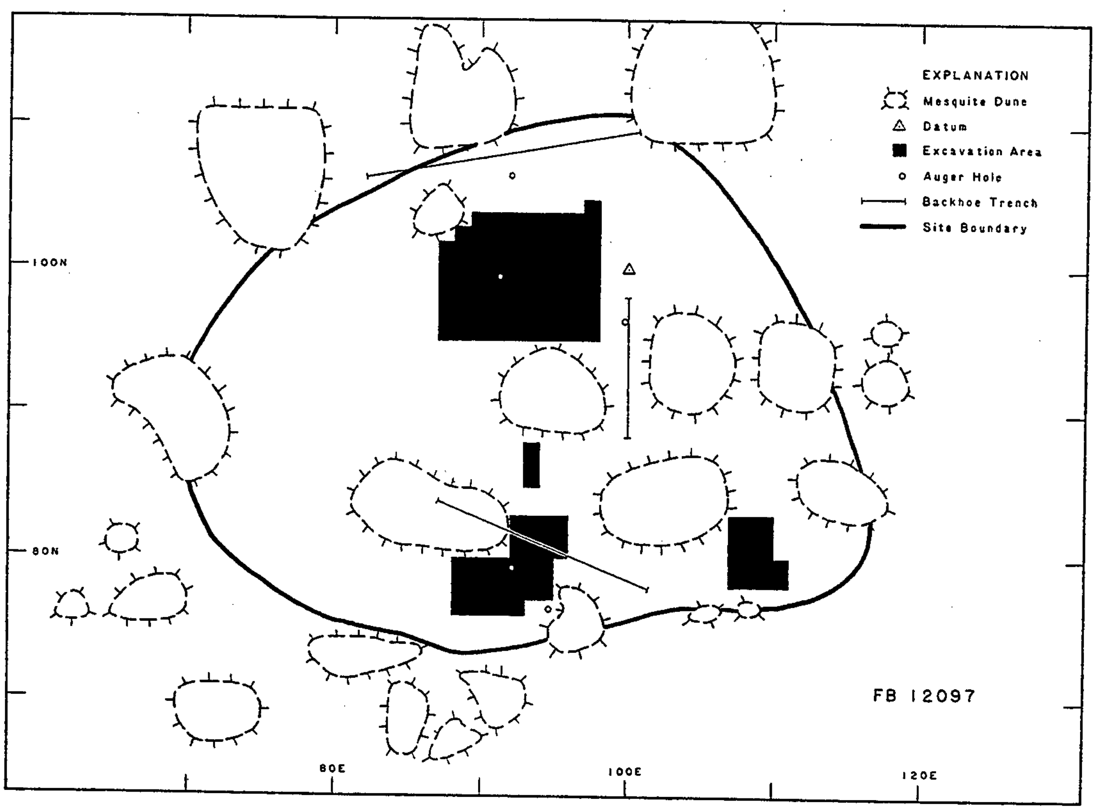
Burned caliche	1
Burned caliche/fire-cracked rock	1
Small stain	1

Square Meters Tested: 156 Subsurface Artifacts: 61
Auger Holes: 5
Backhoe Trenches: 3 = 36 square meters

Three block excavations, a 1-by-3 meter hand excavation trench, five auger holes, and three backhoe trenches were established to mitigate the subsurface potential of cultural evidence on this site.

The largest of the block excavations was a 97-square-meter area located in the north central portion of the site over Feature 1 and 3. A 39-square-meter block was placed in the south-central portion of the site over Feature 2. Seventeen square meters were excavated in the southeast portion of the site over an area where few surface artifacts were collected. The 1-by-3-meter hand excavation trench was placed in the central portion of the site in an area of built-up interdunal sands. The auger holes were excavated through the central portion of the site from the south end to the north end. The backhoe trenches were placed at the north edge, in the





FB12097. *Top,* features; *bottom,* excavation areas.

south-central, and in the east central portions of the site.

No subsurface features were uncovered and the block excavation areas nearly exhausted the research potential of cultural materials. No cultural evidence was uncovered in any of the auger holes or backhoe trenches. The surface collections and the excavations mitigated the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	89	98	Burned caliche	Yes	3
2	92	79	Burned caliche	Yes	3
3	95	96	Small stain <1 meter	Yes	5

FB12100

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
39508	7	1350 ± 90	A.D. 540–890	Mesilla phase
50103	31	1150 ± 50	A.D. 694 –1000	Mesilla phase
50104	32	1110 ± 50	A.D. 777 –1019	Mesilla phase
50105	27 (42)	1010 ± 60	A.D.	Mesilla phase
50106	27 (39, 44)	1010 ± 60	A.D.	Mesilla phase
50107	27 (46)	1110 ± 50	A.D. 777 –1019	Mesilla phase

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-91-459	296	371	1	2.46	El Paso phase/Mesilla phase
DL-91-460	292	378	1	2.41	El Paso phase/Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period
Mimbres Transitional ceramic	A.D. 750–1150	Mesilla phase
*El Paso Polychrome ceramics	A.D.1150–1450	El Paso phase
*Chupadero Black-on-white	A.D.1150–1450	El Paso phase

(* Whalen 1977, 1980)

Size (meters): 10,862

Erosion: Low

Modern Disturbance: Low

Surface Features: 10

Surface Artifacts: 81

Total Features: 34

Tested Features: 33

Feature Types:

Burned caliche	5
Fire-cracked rock	1
Burned caliche/fire-cracked rock	2
Small stain	24
Large stain	2

Square Meters Tested: 285

Subsurface Artifacts: 195

Auger Holes: 22

Unique Artifacts: Low quantity of burned daub in Feature 27

Eight block excavations, two judgmentally placed 1-by-1-meter-square units, a single 1-by-1-meter systematic unit from one of the 49 test units excavated in southernmost grid quad, and 22 auger holes were placed on this site. All excavations and auger tests were within the southernmost grid quad; the site area outside the project area was not tested. The eight blocks, which tested all but one feature, and the portion of the site in which they were located were:

71-square-meter area over Features 11 and 27, northwest portion
53-square-meter block over Features 3 and 4, central portion
50-square-meter block over Feature 2 and 51, central portion
19-square-meter block over Feature 5, central portion
37 square meters over Feature 7, north portion
20-square-meter block over Feature 1, northeast portion
16 square meters were placed over Feature 6, north-central portion
16-square-meter block over Feature 8, northwest portion of the site

Overall, 282 square meters were excavated with the block excavations associated with surface features.

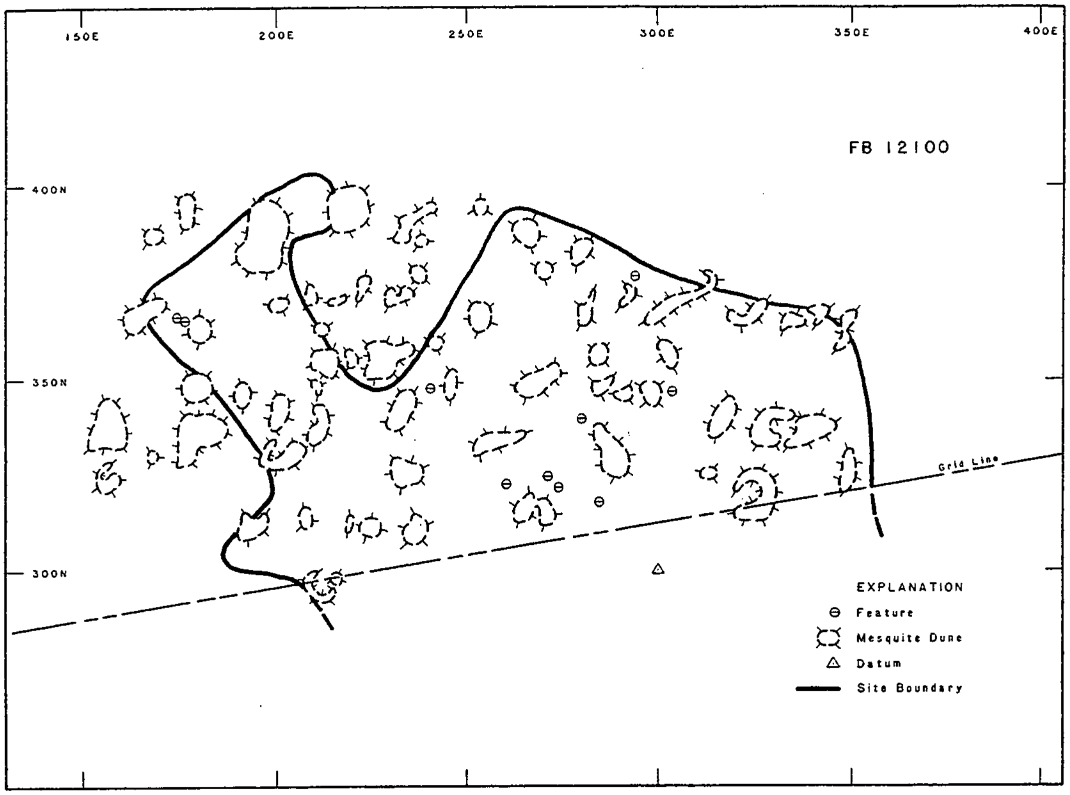
The three 1-by-1-meter units excavated on this site were placed in areas of built-up sands except the systematic unit, which was in a deflated interdunal area. These units were placed in the northwest and north-central portions of the site. The 22 auger test holes were placed throughout the site to test areas associated with features and areas of built-up interdunal sands.

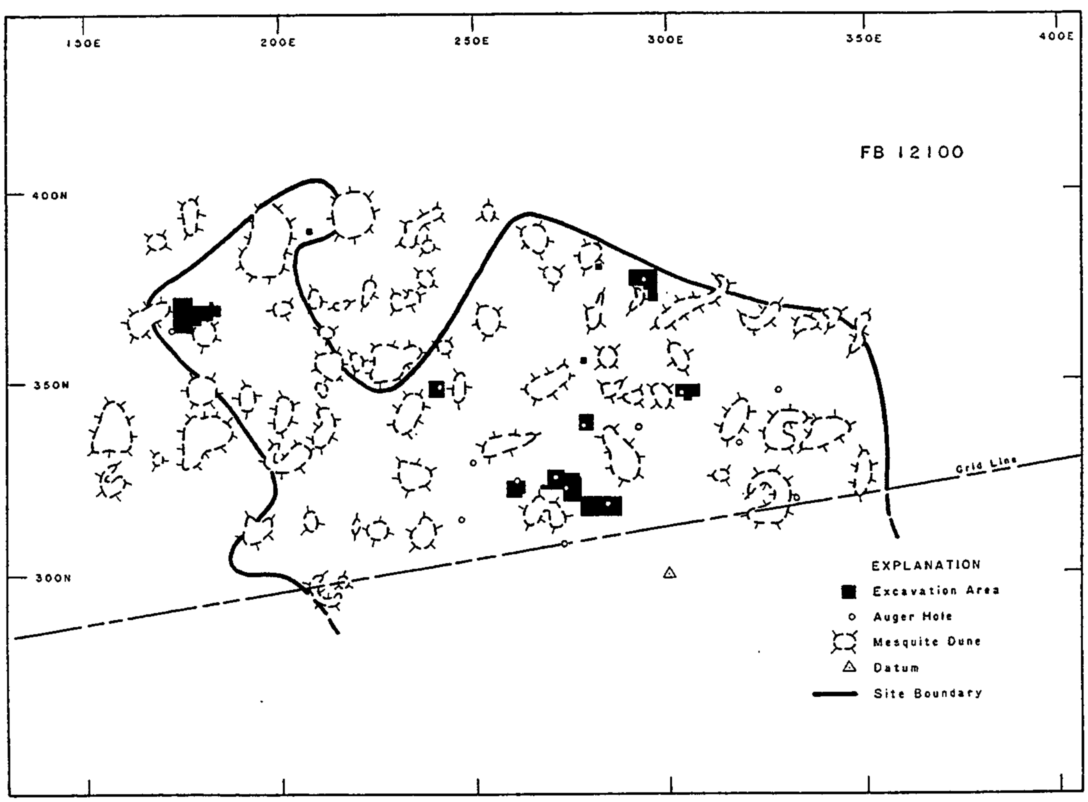
The site extends into the next grid quad to the south outside the Project 90-11 area, but only the surface artifacts within the project area were collected. An additional 18 surface features also were present on FB12100 outside the project area. These were not tested or formally recorded by this project. However, Whalen (1980) reported testing four features in this area. His site designation (31:106:3:844) has been incorporated into the FB12100 site boundaries. He reported a Mesilla phase radiocarbon date as well as one piece of El Paso Polychrome and a single piece of Chupadero Black-on-white pottery.

All block excavations and one of the 1-by-1-meter units contained subsurface cultural materials. None of the excavations exhausted the research potential of cultural evidence. A total of 24 subsurface features were uncovered from the block excavations. These subsurface features consisted of six small ash stains, a D-shaped pithouse, and 17 subfloor features within the pithouse. Auger tests revealed possible subsurface cultural horizons in three locations of the site.

FB12100 still contains significant data given the excavation results, and the minimum deflation. Several features outside the Project 90-11 boundary remain untested.

Feature No.	East	North	Type	Tested	Condition
1	304	347	Small stain <1 meter	Yes	4
2	285	318	Burned caliche	Yes	2
3	275	321	Burned caliche	Yes	2
4	271	324	Small stain <1 meter	Yes	5
5	260	321	Burned caliche/fire-cracked rock/stain	Yes	6
6	279	339	Burned caliche	Yes	2
7	294	376	Burned caliche/fire-cracked rock/stain	Yes	6
8	240	347	Small stain <1 meter	Yes	6
27	175	366	Large stain >1 meter	Yes	6
28	177	362	Small stain <1 meter	No	4





FB12100. *Top,* features; *bottom,* excavation areas.

FB12102 (41EP4908)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
39509	3	2400 ± 60	769–390 B.C.	Late Archaic
39510	9	1710 ± 120	A.D. 30–600	Late Archaic to Mesilla phase

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-91-455	161	84	1	4.58	Mesilla phase
				4.10	Mesilla phase
DL-91-456	161	80	1	3.12	Mesilla phase/El Paso phase
DL-91-457	143	113	1	4.62	Late Archaic/Mesilla phase
				4.01	Mesilla phase
DL-91-458	105	92	1	4.44	Mesilla phase
DL-92-50	81	142	1	2.83	Mesilla phase/El Paso phase
DL-92-108	143	117	1	3.44	Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
El Paso Brown rim	A.D. 250–1150	Mesilla phase

Size (meters): 9,445

Erosion: Low

Modern Disturbance: Low

Surface Features: 9

Total Features: 10

Surface Artifacts: 76

Tested Features: 9

Feature Types:

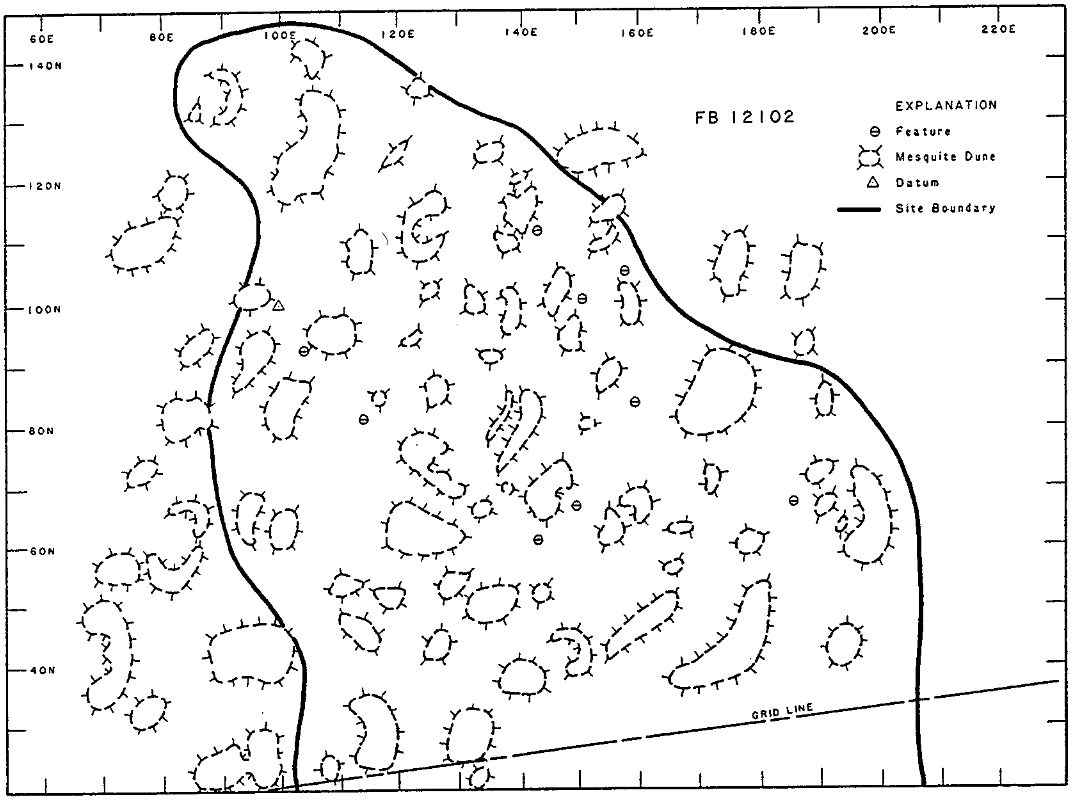
Burned caliche	7
Burned caliche/fire-cracked rock	1
Small stain	2

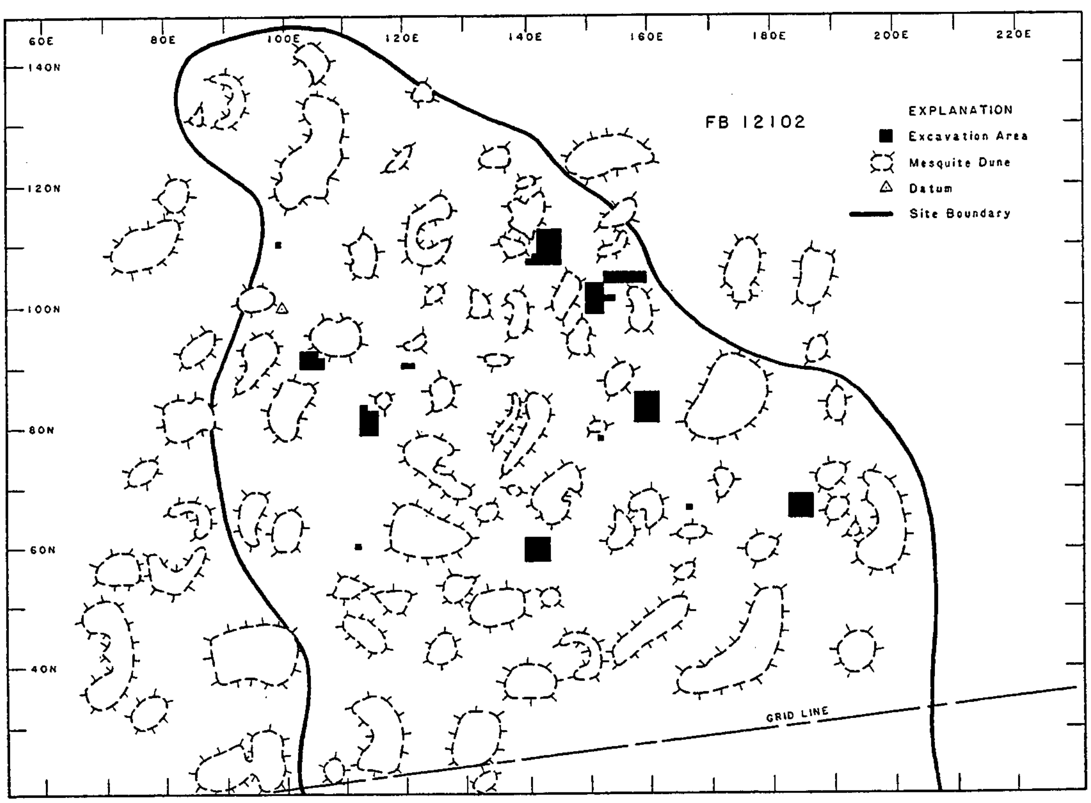
Square Meters Tested: 128

Subsurface Artifacts: 173

FB12102 was tested in eight block excavation areas, five judgmentally placed 1-by-1-meter square units, and another 1-by-1-meter unit that was one of the 49 systematically excavated units in the southernmost grid quad. The block excavations tested certain surface features. Approximately half of FB12102 was in the Project 90-11 area. The site boundary was the only portion of FB12102 that was recorded outside the project area. Surface features were not recorded in the latter area, nor were surface artifacts collected. Excavations on FB12102 and the location within the project area were:

20-square-meter block over Feature 9, northeast portion
17-square-meter block over Feature 6, northeast portion
14-square-meter block over Feature 8, northeast portion
15-square-meter block over Feature 4, northeast portion
13 square meters over Feature 2, northwest portion
11 square meters over Feature 1, northwest portion
16-square-meter block over Feature 3, north-central portion
16-square-meter block over Feature 5, east-central portion of the site





FB12102. *Top,* features; *bottom,* excavation areas.

All 1-by-1-square-meter judgmental units were placed in areas of built-up interdunal or dunal sands throughout the northern portion of the site. One was located aside the systematic 1-by-1-meter unit in the north-central portion of the site to excavate an additional unit in association with a subsurface feature in the systematic excavated unit.

All excavations on this site contained subsurface cultural materials except a few of the 1-by-1-meter units. A single subsurface feature was uncovered from the excavations. None of the excavations exhausted the research potential of cultural materials.

The site still contains significant data given the excavation results. The southern portion of the site outside the Project 90-11 boundary was not tested or surface collected, and surface features and certain areas of the site within the boundary remain untested. The surface of the site is minimally deflated.

Feature No.	East	North	Type	Tested	Condition
1	105	91	Burned caliche with stain	Yes	6
2	114	81	Burned caliche/fire-cracked rock	Yes	3
3	142	60	Small stain <1 meter	Yes	6
4	160	83	Burned caliche	Yes	3
5	185	67	Burned caliche	Yes	3
6	151	101	Burned caliche/fire-cracked rock	Yes	2
8	157	105	Burned caliche/fire-cracked rock	Yes	2
9	144	110	Burned caliche with stain	Yes	6
10	150	66	Burned caliche	No	3

FB12213

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 700

Erosion: Severe — Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	3
Total Features:	1	Tested Features:	1

Feature Types:

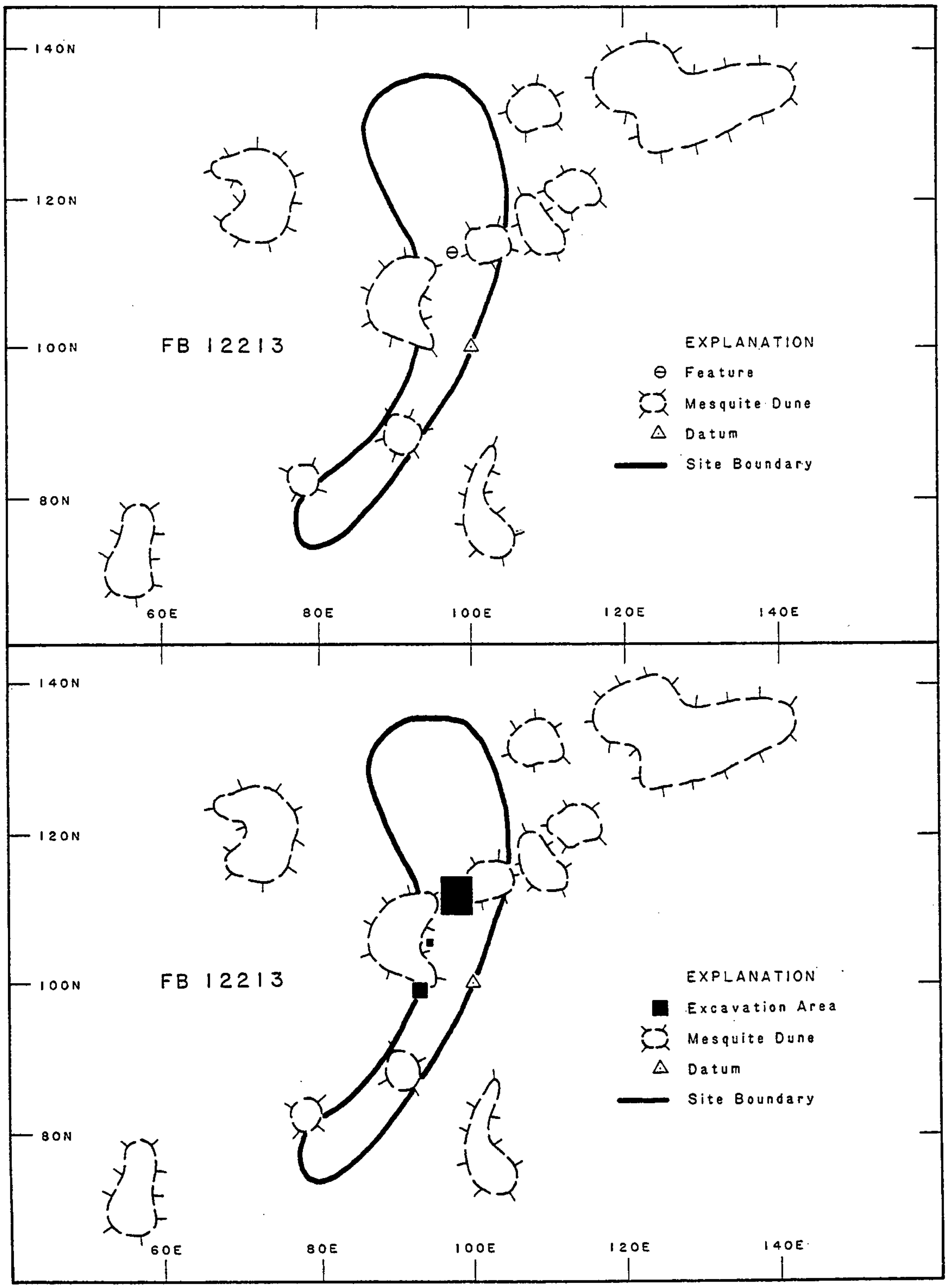
Fire-cracked rock 1

Square Meters Tested: 25 — Subsurface Artifacts: 7

Two block excavations and a single judgmentally placed 1-by-1-meter test unit were established on this site. The largest block excavation area consisted of a 20-square-meter area over the only identified feature. A 4-square-meter block was placed against the south leading edge of a mesquite dune where a single lithic flake was collected off the surface. The 1-by-1-meter unit was placed in the east leading edge of a mesquite dune between the two blocks.

No additional subsurface features and no subsurface cultural materials were uncovered from the excavations except in direct association with Feature 1. The feature block exhausted the research potential of cultural materials. The surface collections and excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	97	112	Fire-cracked rock	1	4



FB12213. *Top,* feature; *bottom,* excavation area.

FB12214

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-47	90	75	1	4.83	Mesilla phase/Late Archaic
				3.19	Mesilla phase
DL-92-48	87	71	0	2.87	Mesilla phase/El Paso phase
DL-92-49	87	72	0	4.89	Mesilla phase/Late Archaic

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	6000–4000 B.C.	Early Archaic
Projectile point	2000 B.C.–A.D. 1150	Late Archaic to Mesilla

Size (meters): 666

Erosion: Moderate   Modern Disturbance: Low

Surface Features:	0	Surface Artifacts:	17
Total Features:	0	Tested Features:	0

Feature Types: None

Square Meters Tested: 12   Subsurface Artifacts: 7

Initial assessments of this site indicated a lack of features or materials suggesting a feature. The surface was initially recorded as severely deflated. The site was considered mitigated as all surface artifacts were collected.

The site was visited during Phase III of the project to verify these conditions. A few additional surface artifacts, which were collected, indicated subsurface cultural materials were eroding out of buried soils. Also, the site's surface was reassessed to only be moderately deflated.

The site area was then tested with three block excavations consisting of 4-square-meter blocks placed in the southeast, northwest, and east portions of the site. Each was located in an area where surface artifacts were collected. Two excavation blocks contained subsurface cultural materials and neither excavation exhausted the horizontal extent of subsurface cultural evidence.

FB 12214 may still contain significant data given the excavation results. Subsurface cultural materials are being exposed, and the site surface is only moderately deflated. Additional testing is required to assess the significance of the site.

FB12216 (41EP4911)

Status: 3 (no significant data remaining)

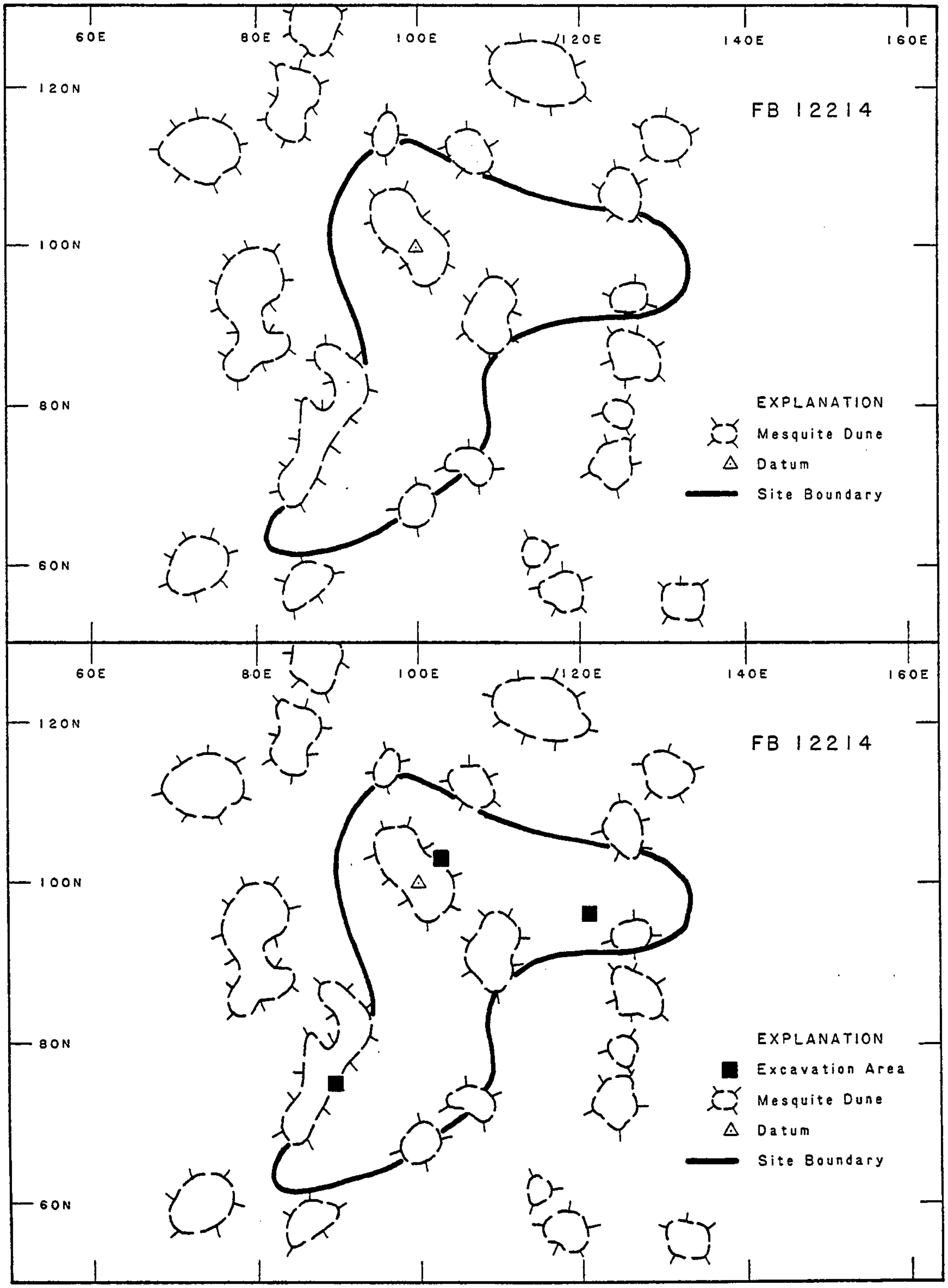
Radiocarbon Dates: None

Diagnostic Artifacts: None

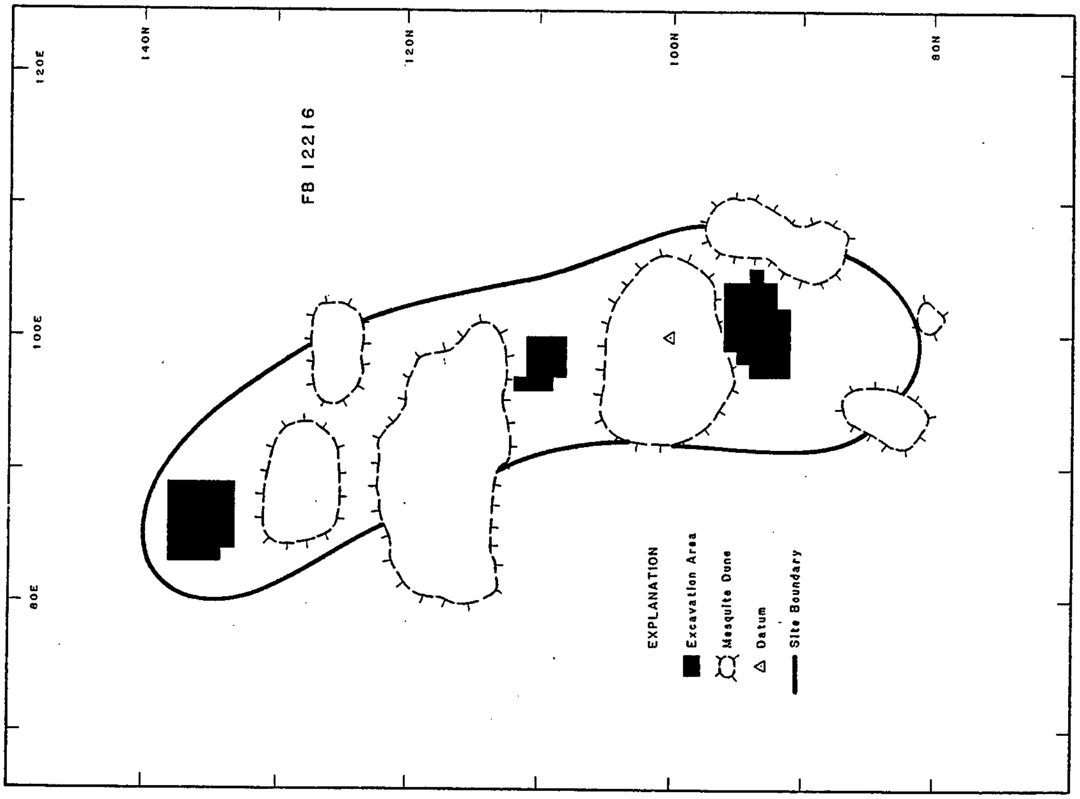
Size (meters): 733

Erosion: Low   Modern Disturbance: Low

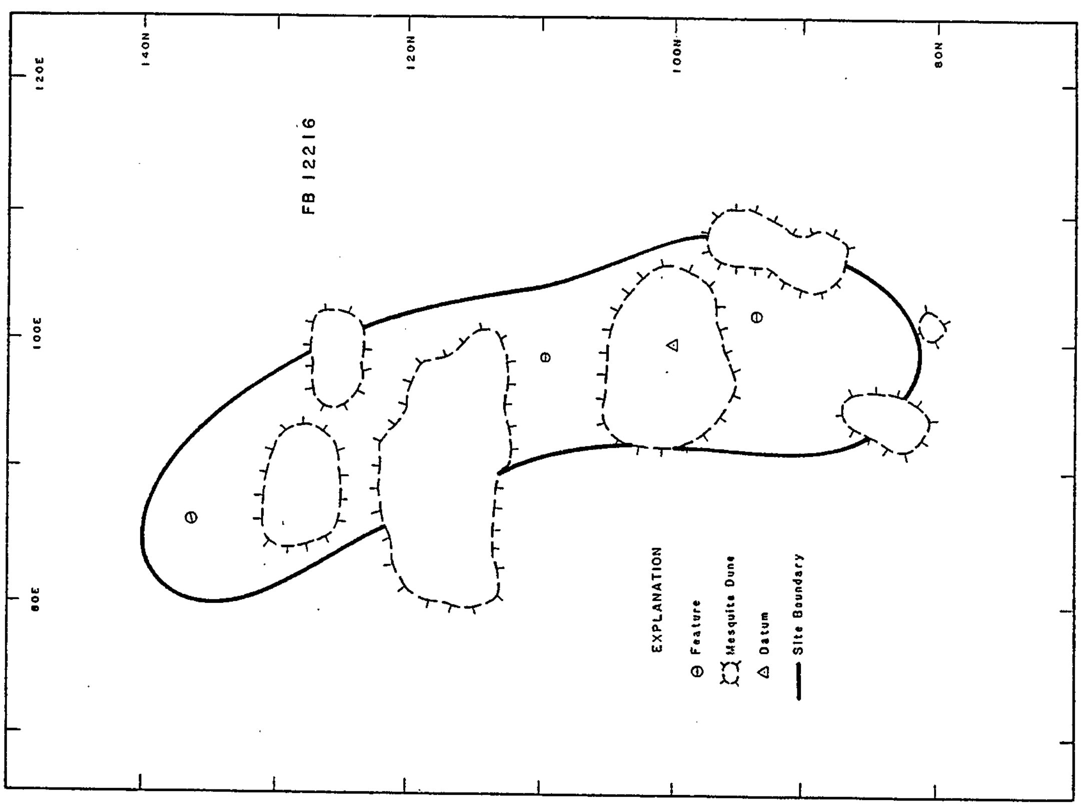
Surface Features:	3	Surface Artifacts:	3
Total Features:	3	Tested Features:	3



FB12214. *Top,* site area; *bottom,* excavation area.



FB12216 (41EP4912), Excavation Areas.



FB12216 (41EP4911), Features.

Feature Types:

Burned caliche	2
Burned caliche/fire-cracked rock	1

Square Meters Tested: 72 Subsurface Artifacts: 8
Auger Holes: 17

Three block excavations and 17 auger holes were placed on this site. Each of the block excavation areas were placed over a surface feature. The largest was a 31-square-meter area in the south portion of the site over Feature 1. A 29-square-meter block was excavated in the north portion of the site over Feature 3. Twelve square meters were placed in the central portion of the site over Feature 2. The auger holes were excavated throughout the site area in association with identified features and in areas of built-up sands.

No additional subsurface features and no subsurface artifact concentrations were uncovered in the block excavations. The auger holes did not reveal any subsurface material. The surface collections and the excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	101	93	Burned caliche	1	2
2	97	110	Burned caliche with stain	1	4
3	86	135	Burned caliche/fire-cracked rock	1	3

FB12217

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-403	74	61	0	2.59	Mesilla phase/El Paso phase

Diagnostic Artifacts: None

Size (meters): 1,240

Erosion: Moderate Modern Disturbance: Low

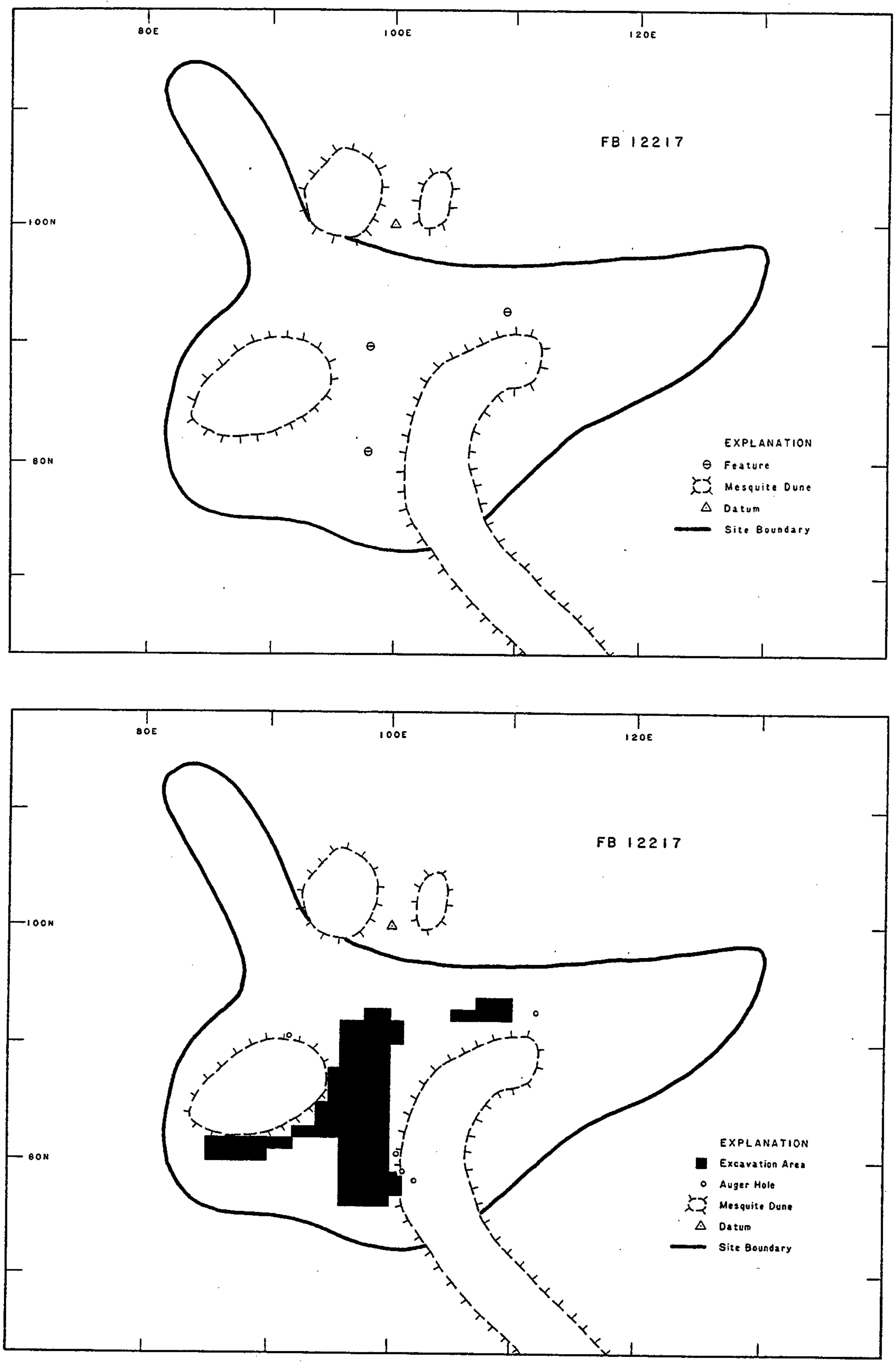
Surface Features:	3	Surface Artifacts:	14
Total Features:	3	Tested Features:	3

Feature Types:

Burned caliche	2
Small stain	1

Square Meters Tested: 101 Subsurface Artifacts: 42
Auger Holes: 10

Three block excavations and 10 auger holes were established to test the site. The block excavations tested each of the surface features. The largest consisted of an 81-square-meter area in the central portion of the site over Features 1 and 2. A 12-square-meter block was excavated adjacent to the latter block to the west to test the southwest portion of the site. Finally, an 8-square-meter block was placed over Feature 3 in the north-central portion of the site.



FB12217. *Top,* features; *bottom,* excavation areas.

All block excavation areas contained subsurface cultural material. None of the excavations appear to have exhausted the research potential of the site. However, none of the auger holes outside the excavation areas recorded any subsurface material.

The site may still contain significant data given the testing results. Portions of the site area still remain untested, and the surface of the site is only moderately deflated. Additional testing is required to assess the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	97	80	Burned caliche	Yes	3
2	97	89	Burned caliche	Yes	2
3	107	93	Small stain <1 meter	Yes	4

FB12218

Status: 2 (requires additional testing)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
39511	4	2190 ± 80	400–4 B.C.	Late Archaic

Diagnostic Artifacts: None

Size (meters): 7,043

Erosion: Low		Modern Disturbance: Low	
Surface Features:	5	Surface Artifacts:	34
Total Features:	6	Tested Features:	6

Feature Types:

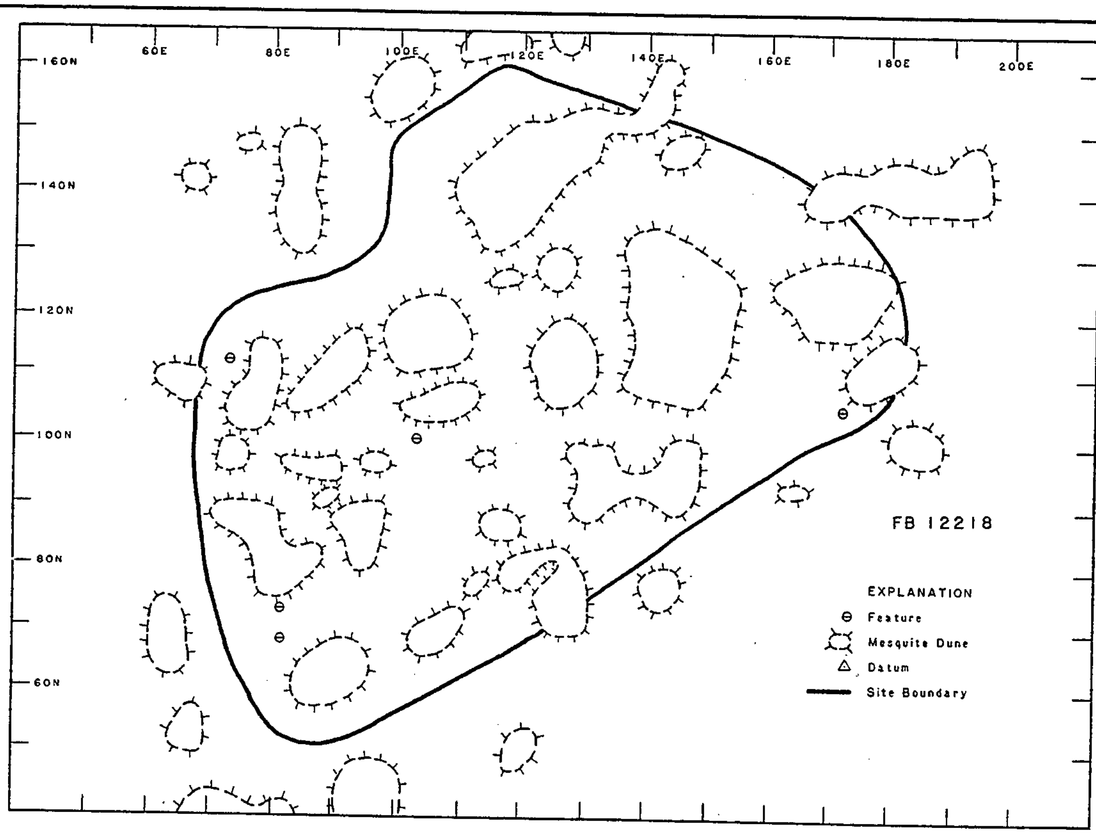
Burned caliche	3
Burned caliche/fire-cracked rock	2
Small stain	1

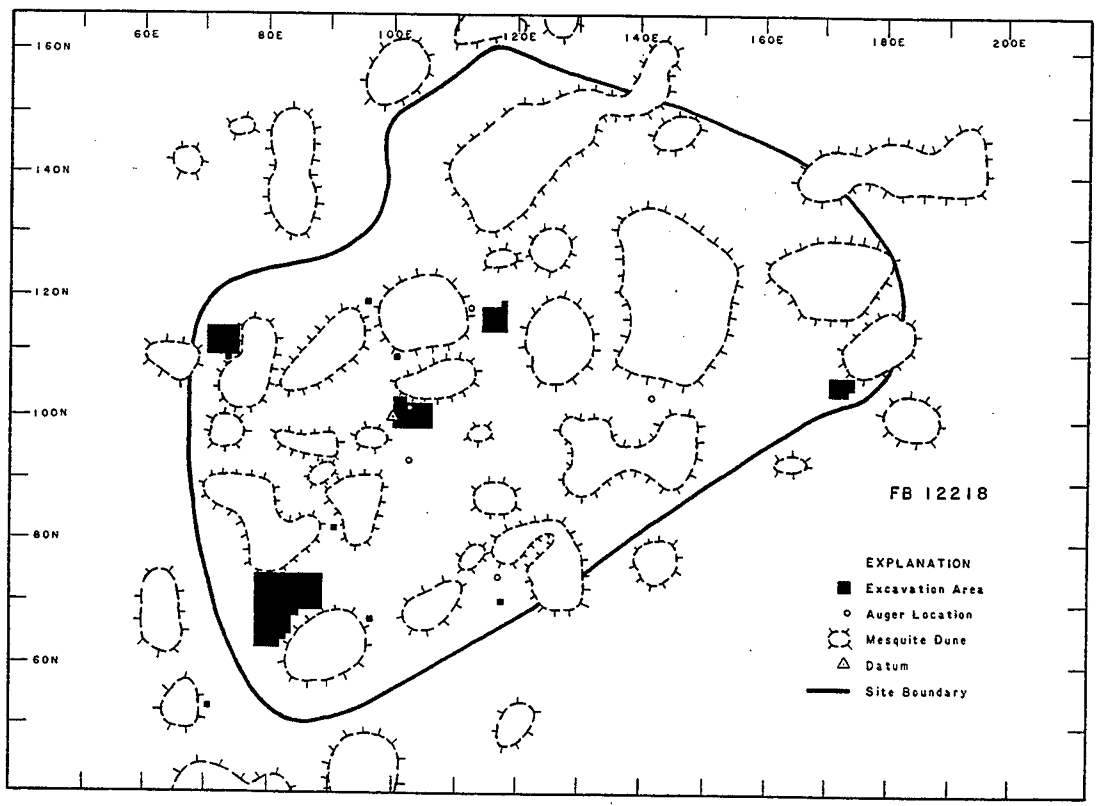
Square Meters Tested: 186 Subsurface Artifacts: 74
Auger Holes: 13

Five block excavations, five 1-by-1-meter square test units, and 14 auger holes were placed on this site. The block excavations tested each of the identified features. The largest of the block excavations consisted of a 100-square-meter area over Features 2 and 3 in the southwest portion of the site. A 32-square-meter block was placed over Feature 1 in the west-central portion of the site. Twenty-one square meters were placed over Feature 5 at the west edge of the site. Seventeen square meters were excavated over Feature 6 in the north-central portion of the site. Finally, an 11-square-meter block was dug over Feature 4 against the east edge of the site. Two of the 1-by-1-meter judgmental test units were in the southwest portion of the site. Another of the 1-by-1-meter units was placed in the southwest-central portion and the remaining two 1-by-1-meter units were placed in the northwest portion of the site. The 13 excavated auger holes were mainly within either the block excavations or were excavated in areas of built-up interdunal sands. Some of the results from the auger holes prompted the excavation of two of the judgmentally placed units within the site area.

One additional 1-by-1-meter judgmentally placed unit was excavated just southwest of the site and an auger hole was excavated in this 1-by-1-meter unit. Neither was included as excavations within the site.

The block excavations and some of the 1-by-1-meter test units contained subsurface cultural materials. None of the block excavation areas exhausted the subsurface horizontal extent of cultural materials. Also, the 1-by-1-meter test units and auger holes against the south edge of the site revealed a subsurface cultural soil horizon associated with a large dune.





FB12218. *Top,* features; *bottom,* excavation areas.

FB12218 may still contain significant data. Areas of the site remain untested and the surface of the site is only partially deflated. Additional testing is required to assess the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	103	100	Burned caliche	Yes	2
2	81	67	Burned caliche/fire-cracked rock	Yes	3
3	83	72	Burned caliche	No	2
4	172	105	Small stain <1 meter	Yes	6
5	73	112	Burned caliche	Yes	2

FB12219

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 2,230

Erosion: Low

Modern Disturbance: Low

Surface Features: 3

Surface Artifacts: 52

Total Features: 4

Tested Features: 4

Feature Types:

Burned caliche/fire-cracked rock	2
Small stain	2

Square Meters Tested: 88

Subsurface Artifacts: 149

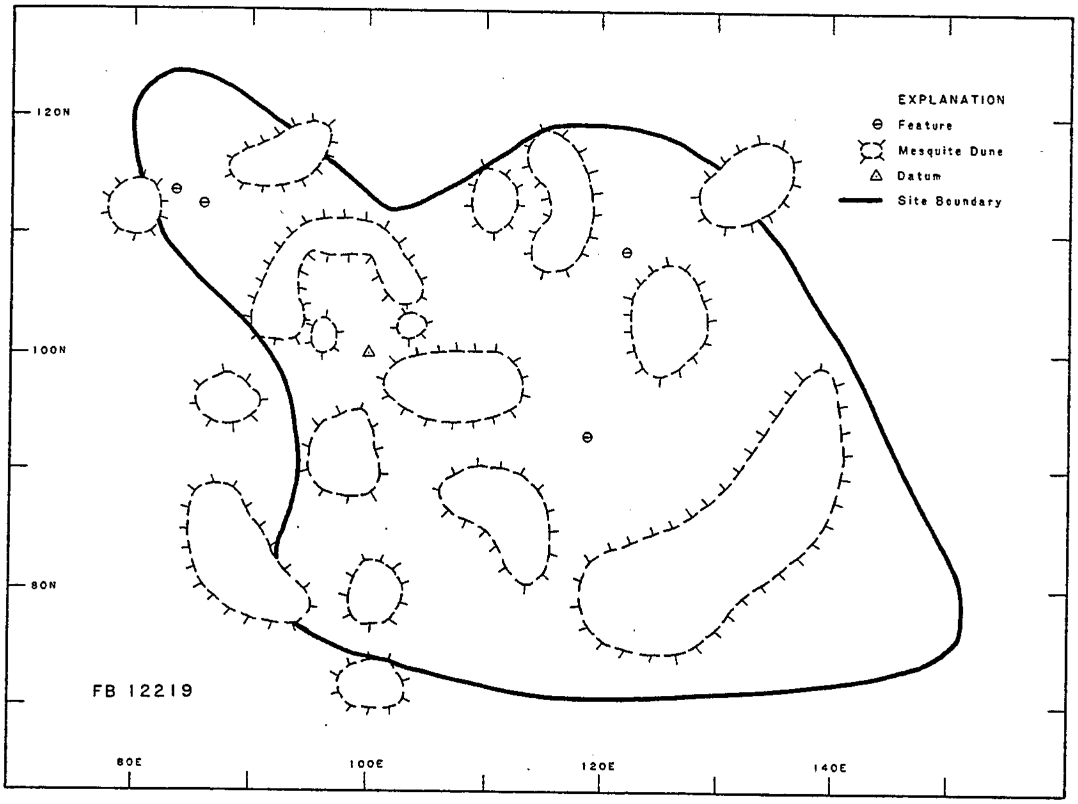
Auger Holes: 10

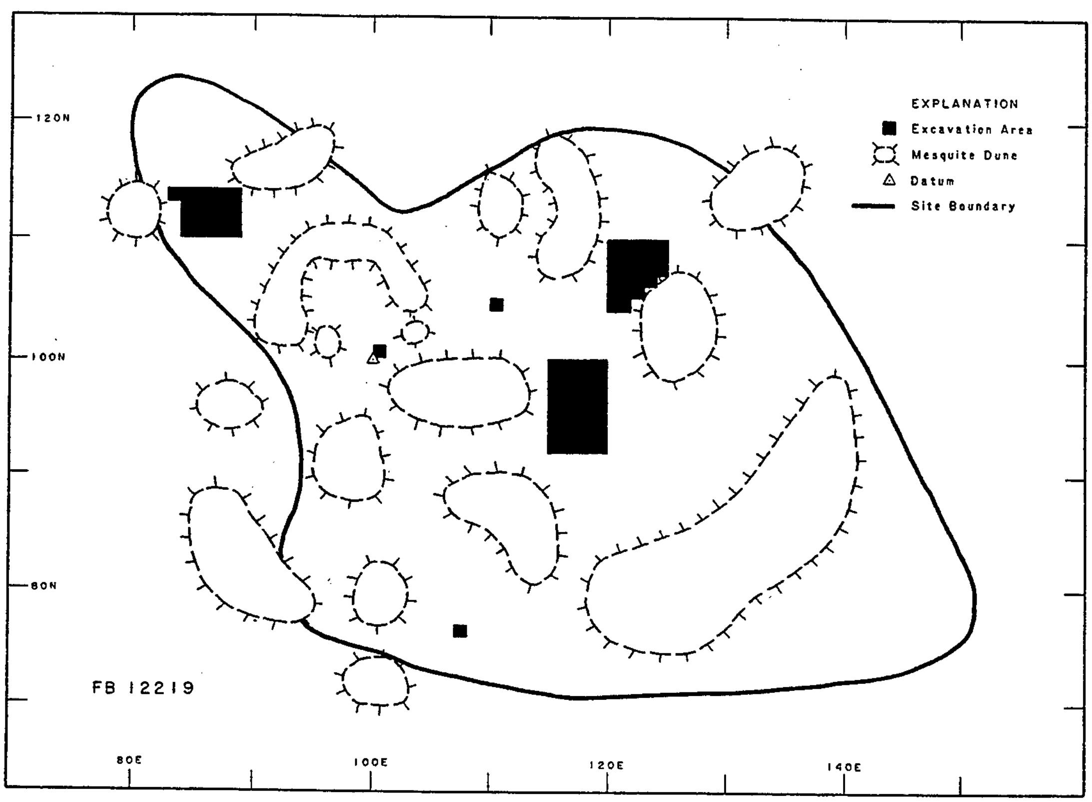
Three block excavations, three square 1-by-1-meter judgmental test units, and 10 auger holes constituted testing of this site. The largest of the block excavations consisted of a 40-square-meter area over Feature 1 in the central portion of the site. A 24-square-meter block was placed over Feature 2. A 21-square-meter block was excavated over Features 3 and 4 in the northwest portion of the site. One of the 1-by-1-meter test units was placed in the south portion of the site while the remaining two test units were excavated in the northwest portion of the site.

The block excavations revealed subsurface cultural materials. None of these excavations appears to have exhausted the research potential of these areas. Two of the 1-by-1-meter test units contained subsurface cultural materials in areas where no surface evidence was present. However, auger test holes revealed no evidence of subsurface material.

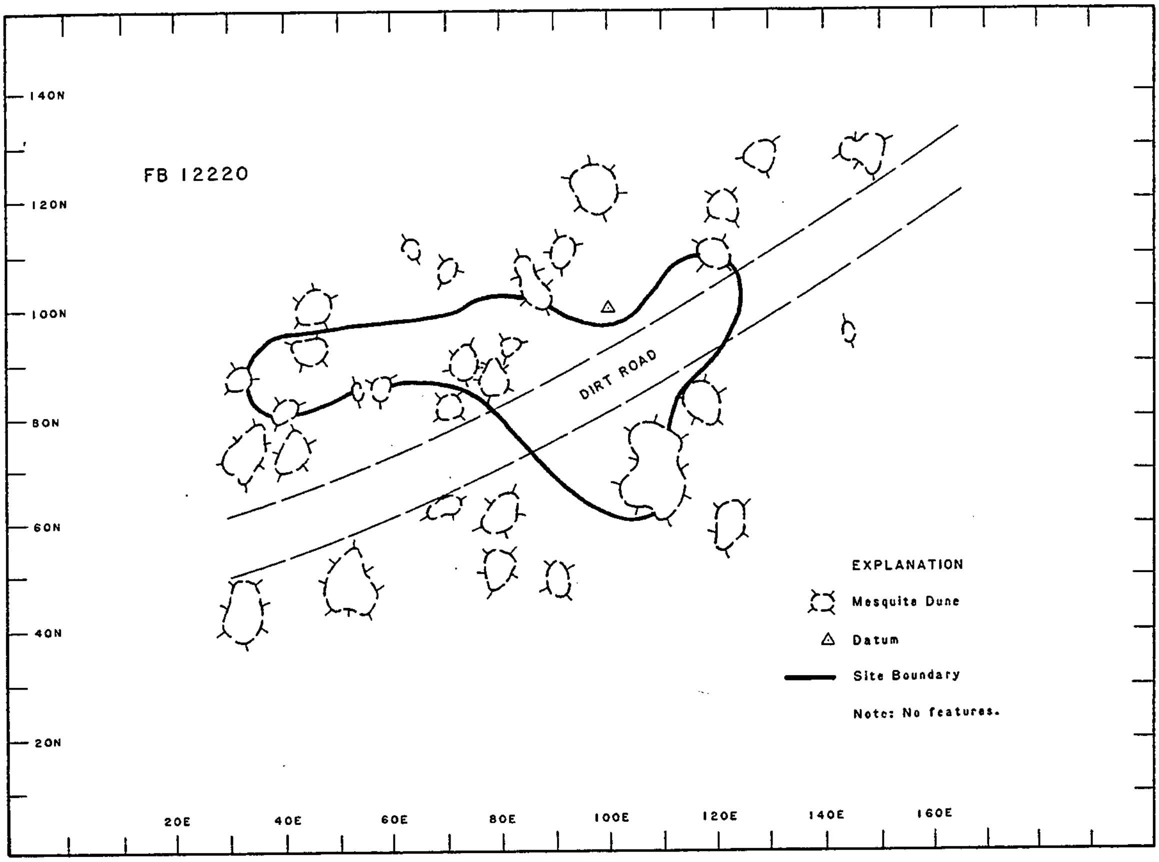
The site may still contain significant data given the excavation results. Areas of the site remain untested, and the surface of the site is minimally deflated. Additional testing is required to assess the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	119	93	Burned caliche/fire-cracked rock	Yes	4
2	122	107	Burned caliche/fire-cracked rock	Yes	3
4	83	113	Small stain <1 meter	Yes	6





FB12219. *Top,* features; *bottom,* excavation areas.



FB12220.

FB12220

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 2,344

Erosion: Moderate

Modern Disturbance: Severe

Surface Features: 0
Total Features: 0
Feature Types: None

Surface Artifacts: 4
Tested Features: 0

Square Meters Tested: 0

Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. FB12220 may still contain significant data. No testing of the site area was conducted. The surface of the site was only moderately deflated. Testing is required to assess the research potential of the site.

FB12221 (41EP4912)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-404	226	185	0	4.34	Mesilla phase
DL-92-405	220	166	0	2.98	Mesilla phase/El Paso phase
DL-92-406	29	220	0	2.62	El Paso phase/Mesilla phase

Diagnostic Artifacts: None

Size (meters): 11,262

Erosion: Moderate   Modern Disturbance: Low

Surface Features:	12	Surface Artifacts:	76
Total Features:	12	Tested Features:	1

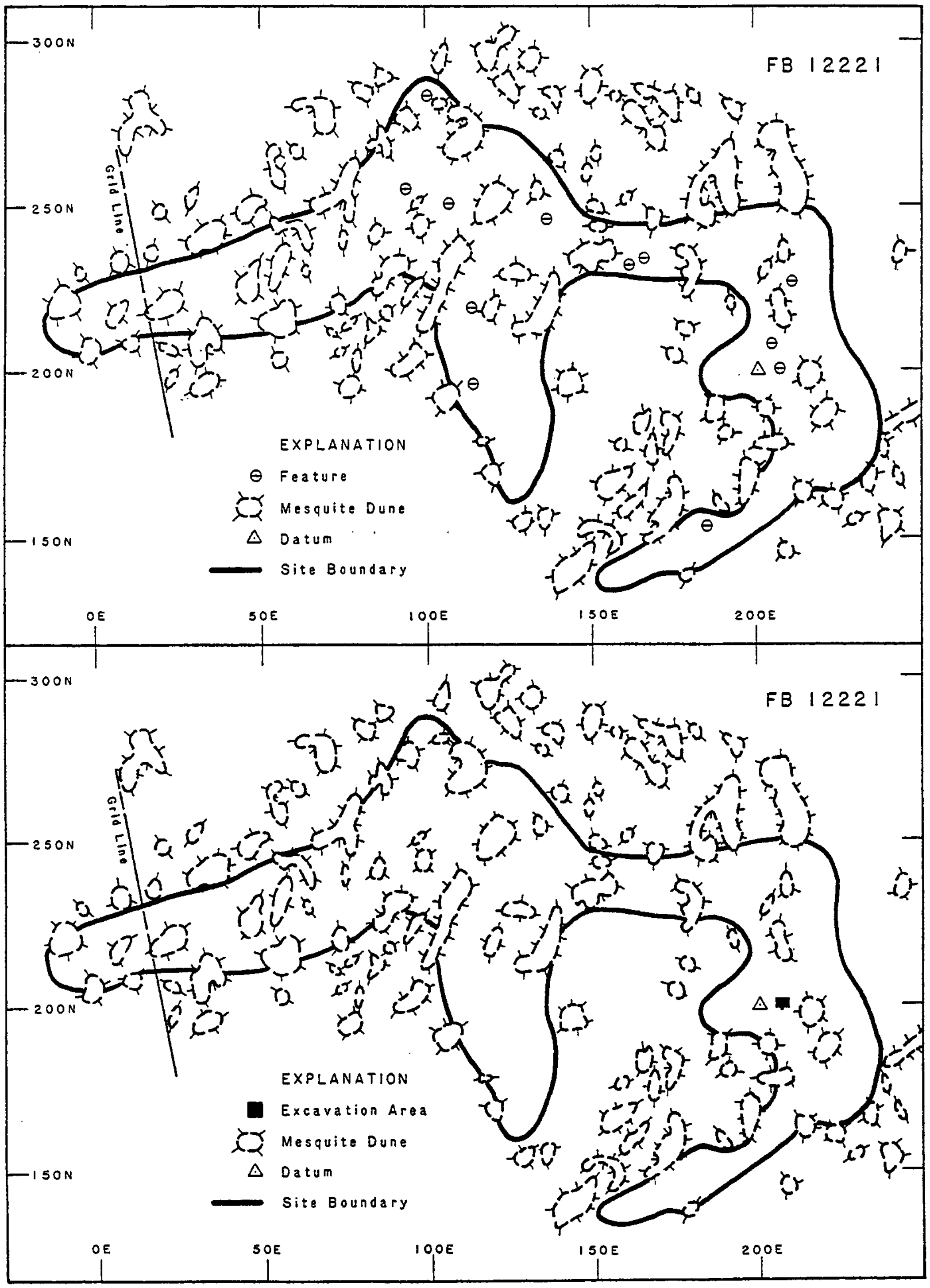
Feature Types:

Burned caliche	4
Burned caliche/fire-cracked rock	7
Small stain	1

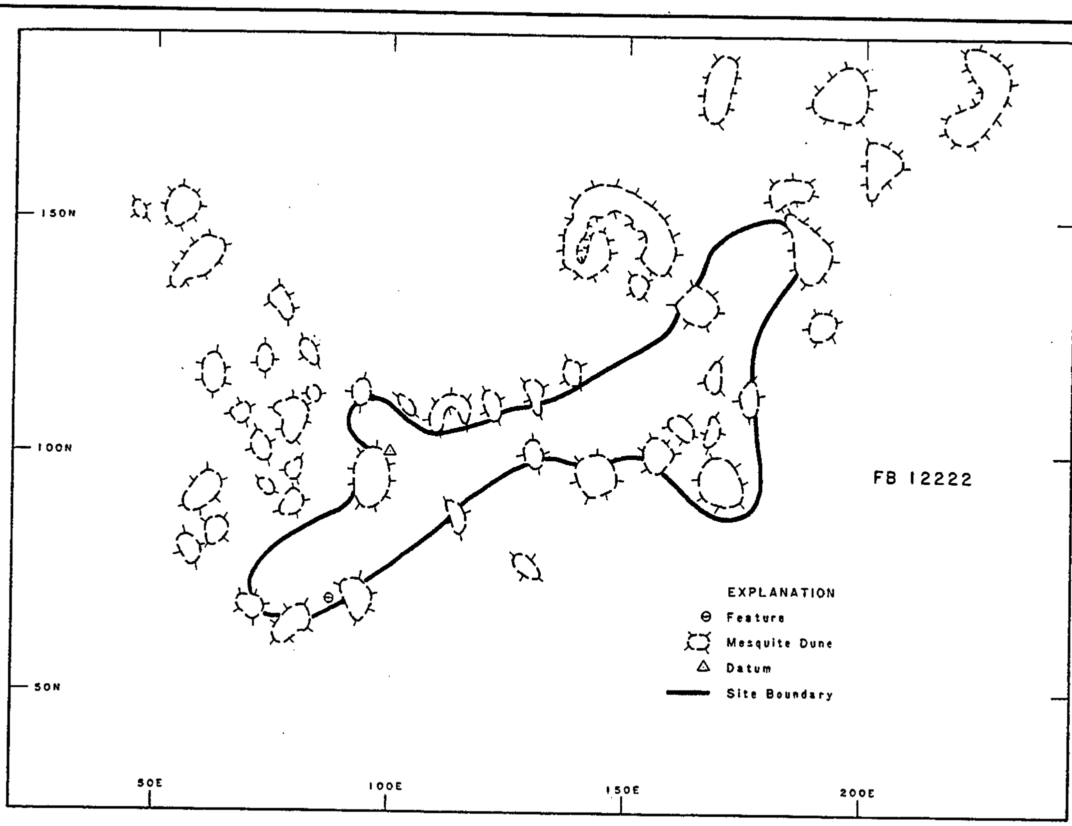
Square Meters Tested: 13   Subsurface Artifacts: 4
Historic Artifacts: 1 US Army knife (A.D.1941)

A single block excavation consisted of a 13-square-meter area over Feature 2 in the eastern portion of the site. The block excavation area uncovered an intact portion of the original Feature 2 as well as subsurface cultural materials. It did not exhaust the research potential of cultural materials. Significant data still remain on this site given excavation results. Only one of twelve surface features has been tested, large portions of the site area were not tested, and the surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	204	208	Burned caliche	No	4
2	207	201	Burned caliche/fire-cracked rock	Yes	4
3	211	227	Burned caliche	No	3
4	165	234	Burned caliche	No	4
5	161	232	Burned caliche/fire-cracked rock	No	5
6	136	246	Burned caliche	No	3
7	107	251	Burned caliche/fire-cracked rock	No	4
8	94	255	Burned caliche/fire-cracked rock	No	4
9	100	284	Burned caliche/fire-cracked rock	No	3
10	114	219	Burned caliche/fire-cracked rock	No	3
11	114	196	Burned caliche/fire-cracked rock	No	4
12	184	153	Small stain <1 meter	No	2



FB12221 (41EP4912). *Top,* site area; *bottom,* excavation area.



FB12222.

FB12222

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-42	106	98	0	3.86	Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 3,754

Erosion: Moderate

Modern Disturbance: Low

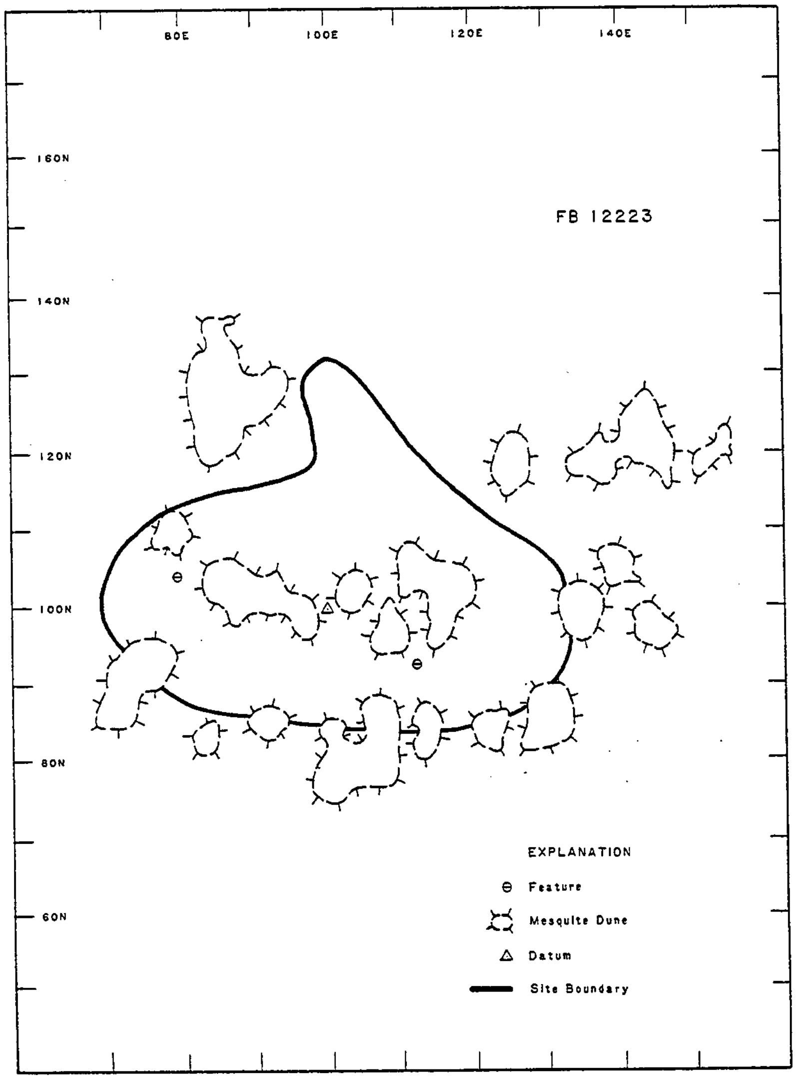
Surface Features:	1	Surface Artifacts:	25
Total Features:	1	Tested Features:	0

Feature Types:

Burned caliche	1

Square Meters Tested: 0

Subsurface Artifacts: 0



FB12223.

All surface artifacts were collected during Phase II of the project. Although the site may still contain significant data, no testing was conducted. The site surface is moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	87	70	Burned caliche	No	3

FB12223

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1,963

Erosion: Severe | Modern Disturbance: Moderate

Surface Features: 2 | Surface Artifacts: 10

Total Features: 2 Tested Features: 0

Feature Types:

Burned caliche 2

Square Meters Tested: 0 Subsurface Artifacts: 0

All surface artifacts on this site were collected during Phase II of the project. The site may still contain significant data. No testing of the site area was conducted.

Feature No.	East	North	Type	Tested	Condition
1	113	93	Burned caliche	No	5
2	80	104	Burned caliche	No	3

FB12224 (41EP4913)

Status: 2 (requires additional testing)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43210	4	3790 ± 60	2470–2035 B.C.	Middle Archaic

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	2000 B.C.– A.D. 1150	Late Archaic to Mesilla phase

Size (meters): 3,694

Erosion: Severe Modern Disturbance: Moderate

Surface Features: 4 Surface Artifacts: 15

Total Features: 4 Tested Features: 2

Feature Types:

Burned caliche/fire-cracked rock 3

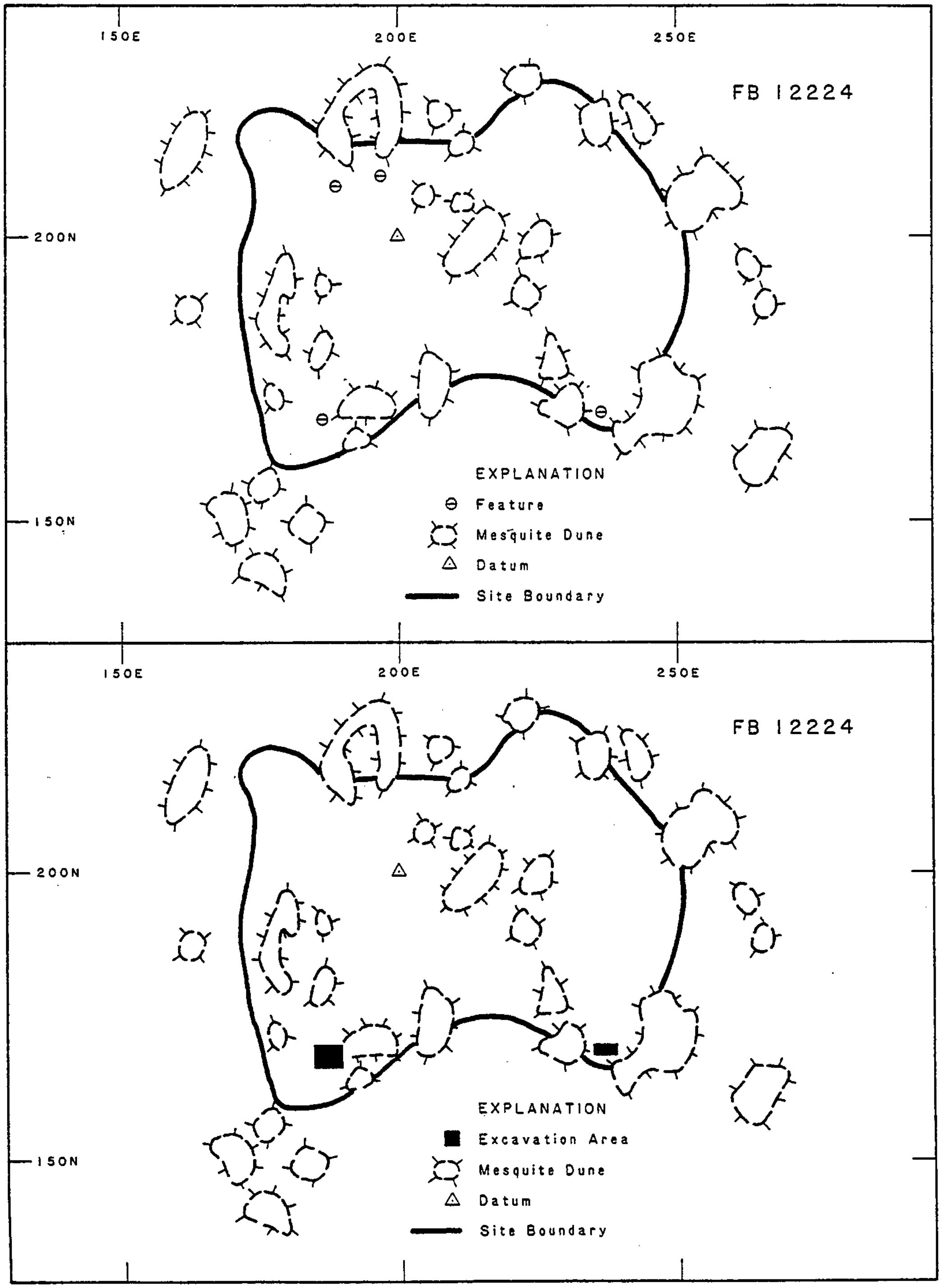
Small stain 1

Square Meters Tested: 28 Subsurface Artifacts: 4

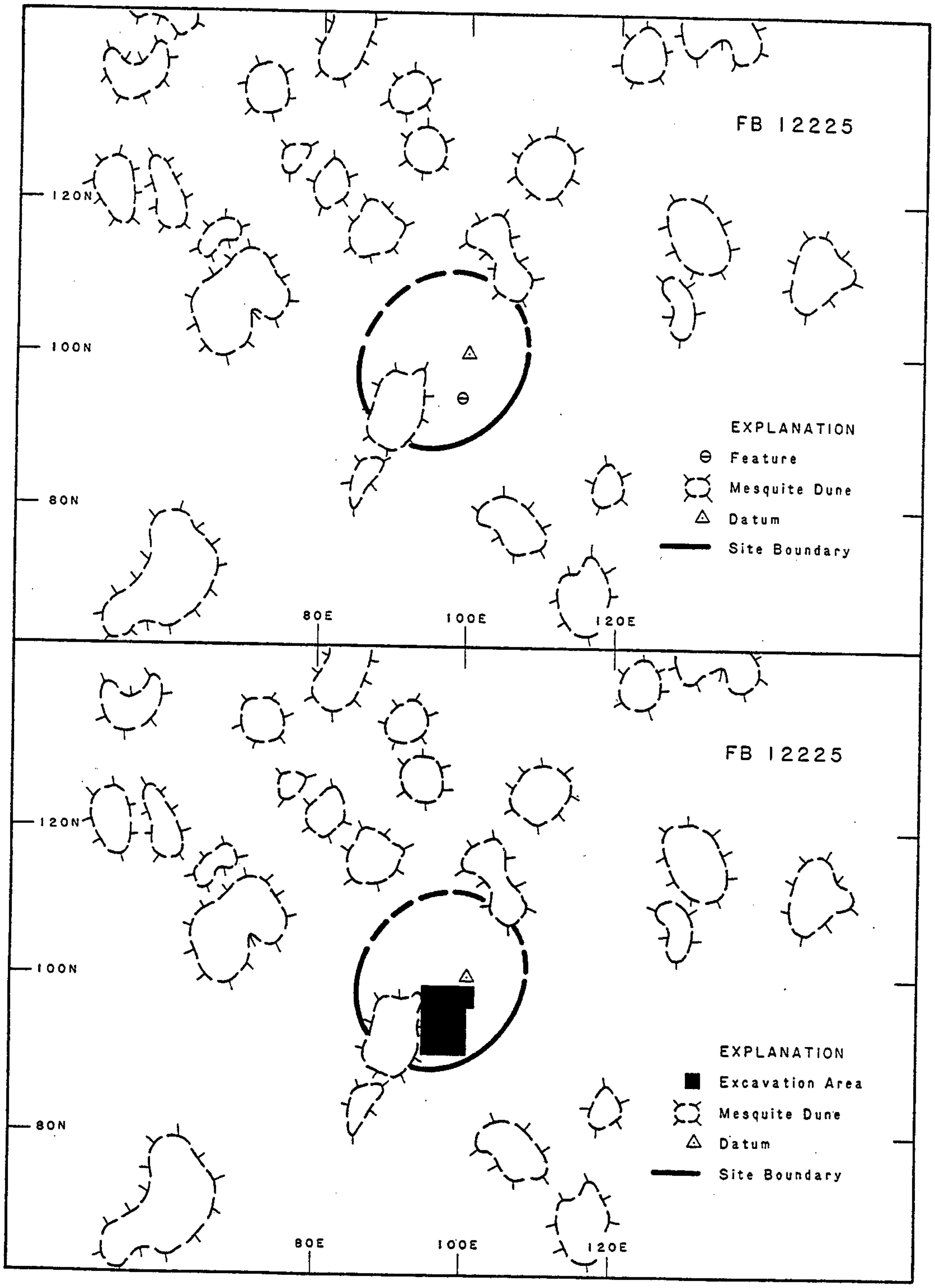
Two block excavations were used to test two surface features; no other testing was conducted. The largest of the block excavations was a 20-square-meter area over Feature 1 in the southwest portion of the site. Eight square meters were excavated over Feature 4 in the southeast portion of the site. The Feature 1 block excavation uncovered subsurface cultural materials and did not exhaust the horizontal extent of these materials. No subsurface cultural material was present in the Feature 4 block except Feature 4.

FB12224 may still contain significant data as indicated by the excavation results on Feature 1. Large areas of the site remain untested and two surface features were not tested. Additional testing of the site is required to assess its significance.

Feature No.	East	North	Type	Tested	Condition
1	187	169	Burned caliche	Yes	5
2	189	209	Burned caliche/fire-cracked rock	No	5
3	197	210	Burned caliche/fire-cracked rock	No	4
4	237	169	Burned caliche with stain	Yes	5



FB12224 (41EP4913). *Top,* site area; *bottom,* excavation area.



FB12225 (41EP4914). *Top,* site area; *bottom,* excavation area.

FB12225 (41EP4914)

Status: 1 (significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43211	1	2930 ± 90	1369–900 B.C.	Late Archaic
50108	1	2850 ± 100		
50109	2	2920 ± 60	1372–932 B.C.	Late Archaic

Diagnostic Artifacts: None

Size (meters): 146

Erosion: Low — Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	1
Total Features:	4	Tested Features:	4

Feature Types:

Small stain	4

Square Meters Tested: 57 — Subsurface Artifacts: 7

A single large block excavation consisted of a 57-square-meter area centered over Feature 1, which comprised the entire site on the surface. The Phase II assessment of site erosion as severe was concerned primarily with Feature 1. Block excavation revealed three additional subsurface features and a few artifacts. These excavations revealed the majority of the site area extends to the north into built-up interdunal sands. This area is only partially deflated. Excavations did not exhaust the research potential.

FB12225 still contains significant data given the excavation results indicating the site continues north under built-up surface sands and is only minimally deflated.

Feature No.	East	North	Type	Tested	Condition
1	99	94	Small stain <1 meter	Yes	7

FB12226

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 512

Erosion: Low — Modern Disturbance: Low

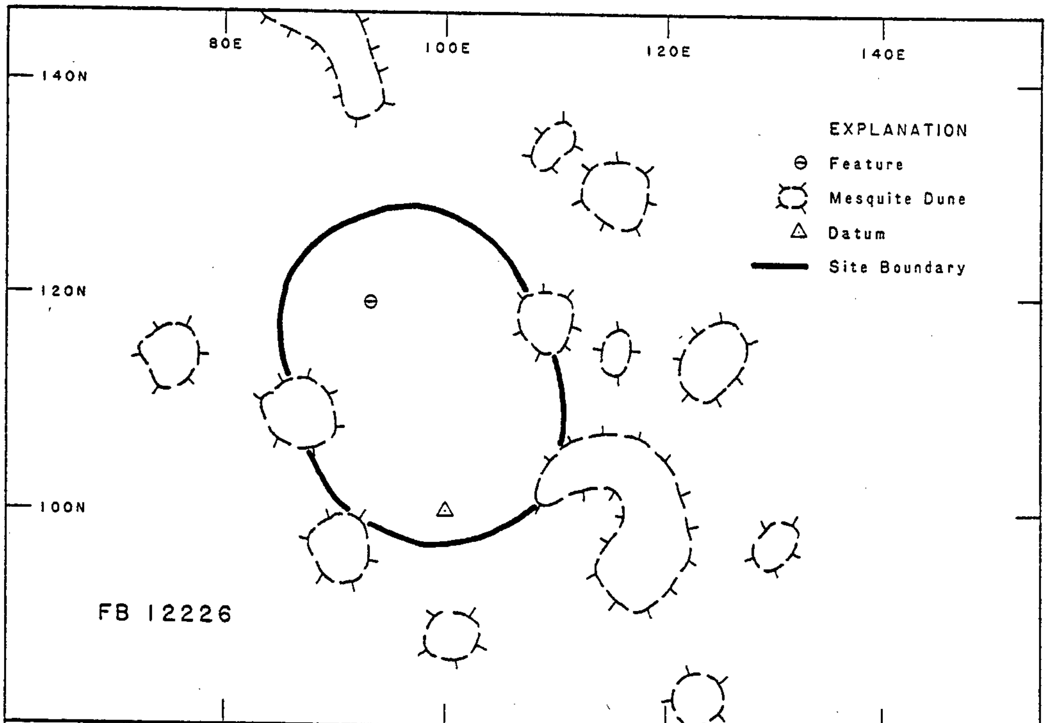
Surface Features:	1	Surface Artifacts:	2
Total Features:	2	Tested Features:	2

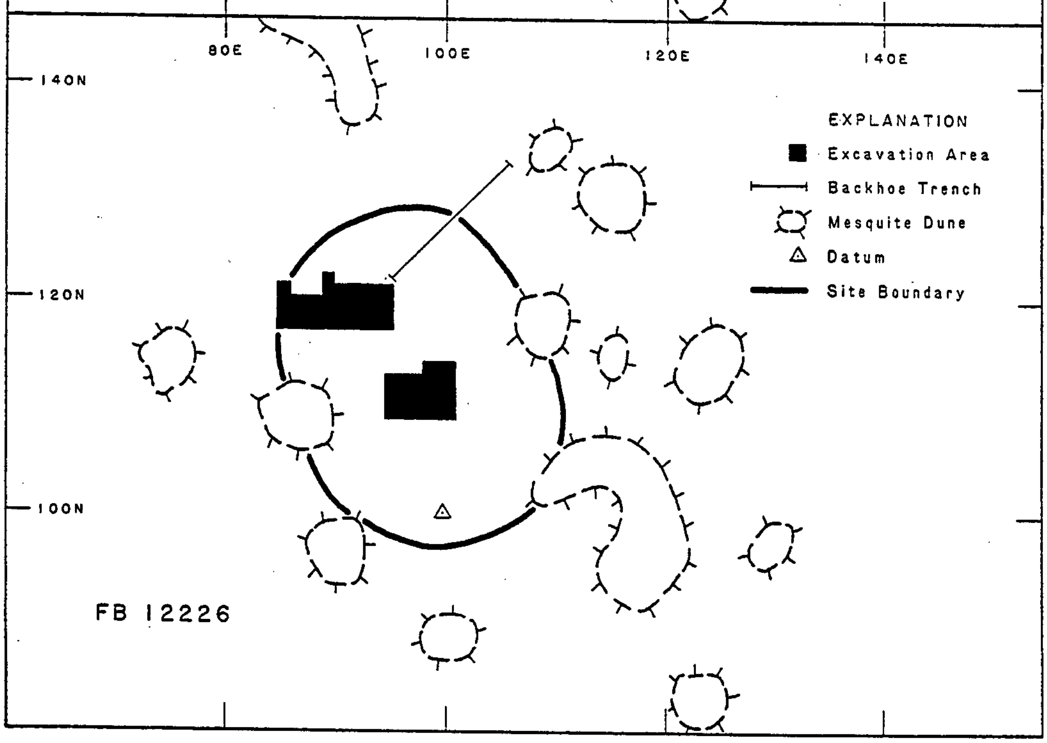
Feature Types:

Burned caliche/fire-cracked rock	1
Small stain	1

Square Meters Tested: 65 — Subsurface Artifacts: 8

Backhoe Trenches: 1 = 13 square meters





FB12226. *Top,* site area; *bottom,* excavation area.

Two block excavations and a single backhoe trench were established on this site. The largest block excavations consisted of a 38-square-meter area at the north edge of the site over and west of Feature 1. A 27-square-meter block excavation was established in the central portion of the site over an area where a few burned caliche pieces and two lithic artifacts were collected off the surface. The backhoe trench was excavated in the northeast portion of the site.

The block excavations uncovered subsurface cultural materials and an additional feature. The smaller block contained additional subsurface burned caliche indicating another feature may lie below the surface in the southern portion of the site. The larger block revealed a cultural soil horizon against the north profile of the excavation and extending north into areas of built-up interdunal sands.

FB12226 may still contain significant data. The site surface is only partially deflated and a buried soil horizon was defined in a profile. Additional testing is required to assess the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	94	119	Burned caliche	Yes	6

FB12227

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 56

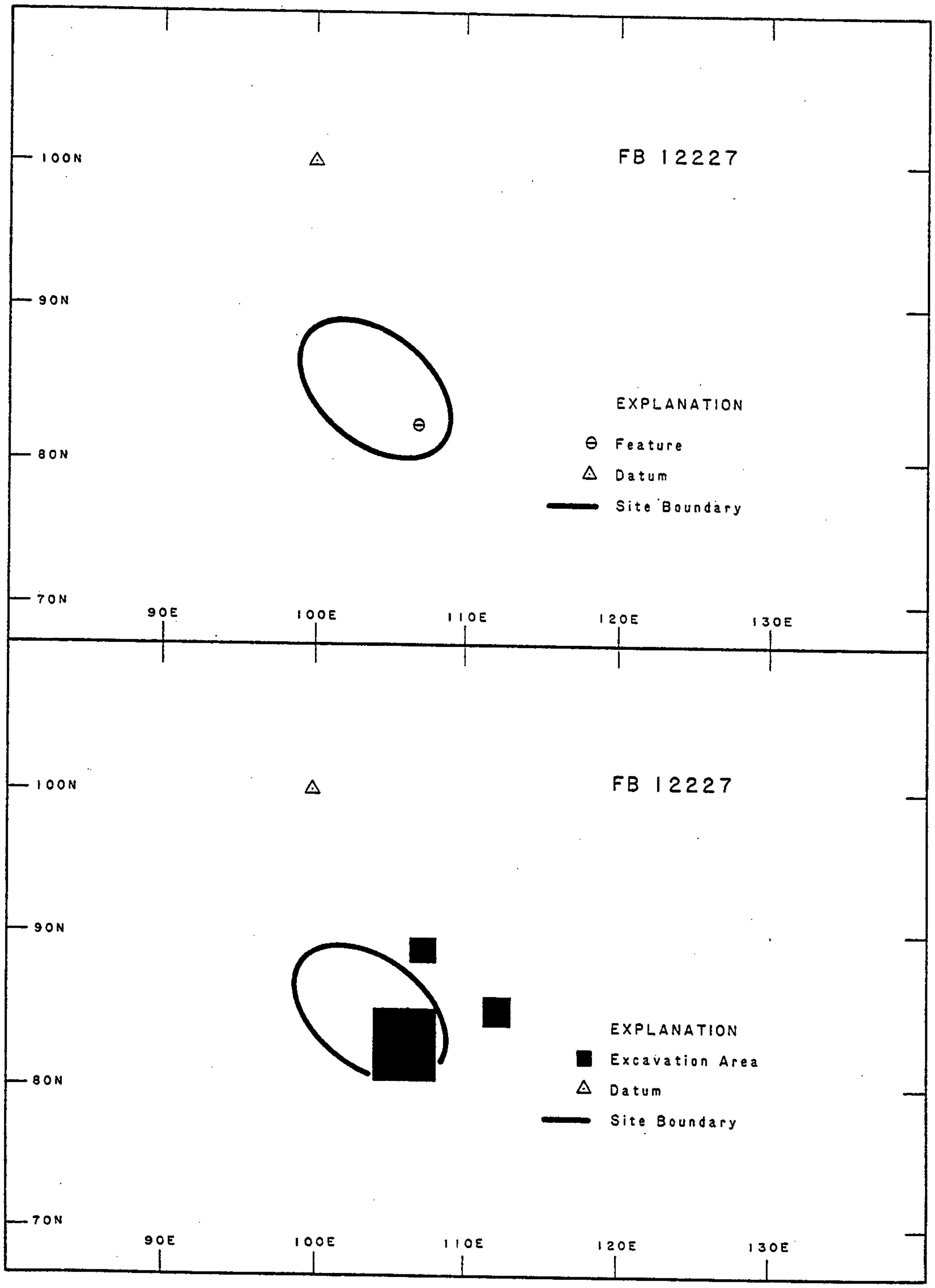
Erosion: Severe		Modern Disturbance: Severe	
Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	1
Feature Types:			
Burned caliche		1	

Square Meters Tested: 28 | Subsurface Artifacts: 0

Three block excavations were established on this site. The largest consisted of a 20-square-meter area over the only surface cultural manifestation of the site. Four square meters were excavated east-northeast of the large block and another 4 square meters were placed to the north of the largest block. These smaller blocks were in areas of built-up sands on the edge of the site.

No subsurface features or cultural material concentrations were uncovered from the excavations. The largest block contained few materials while the 4-square-meter blocks contained no subsurface material. The collections of the few pieces of surface burned caliche, the excavations conducted, and the severe deflation and disturbance of the surface of this site indicate that FB12227 has no remaining research potential.

Feature No.	East	North	Type	Tested	Condition
1	106	82	Burned caliche	Yes	3



FB12227. *Top,* site area; *bottom,* excavation area.

FB12228

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 163

Erosion: Severe   Modern Disturbance: None

Surface Features:	1	Surface Artifacts:	2
Total Features:	1	Tested Features:	1
Feature Types:			
Burned caliche		1	

Square Meters Tested: 24   Subsurface Artifacts: 7

Two block excavations were established to mitigate the potential for subsurface material on this site. The largest consisted of a 20-square-meter area placed over the major surface manifestation of the only feature identified. Four square meters were established in the west portion of the site over a slight surface concentration of burned caliche pieces.

No additional subsurface features or concentrations of cultural materials were uncovered in the excavations. Excavations found a few subsurface cultural materials, though nearly exhausted the horizontal extent of these materials.

The surface collections and the excavations results, in combination with the fact the surface of the site is severely deflated, has resulted in the mitigation of the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	86	102	Burned caliche	Yes	5

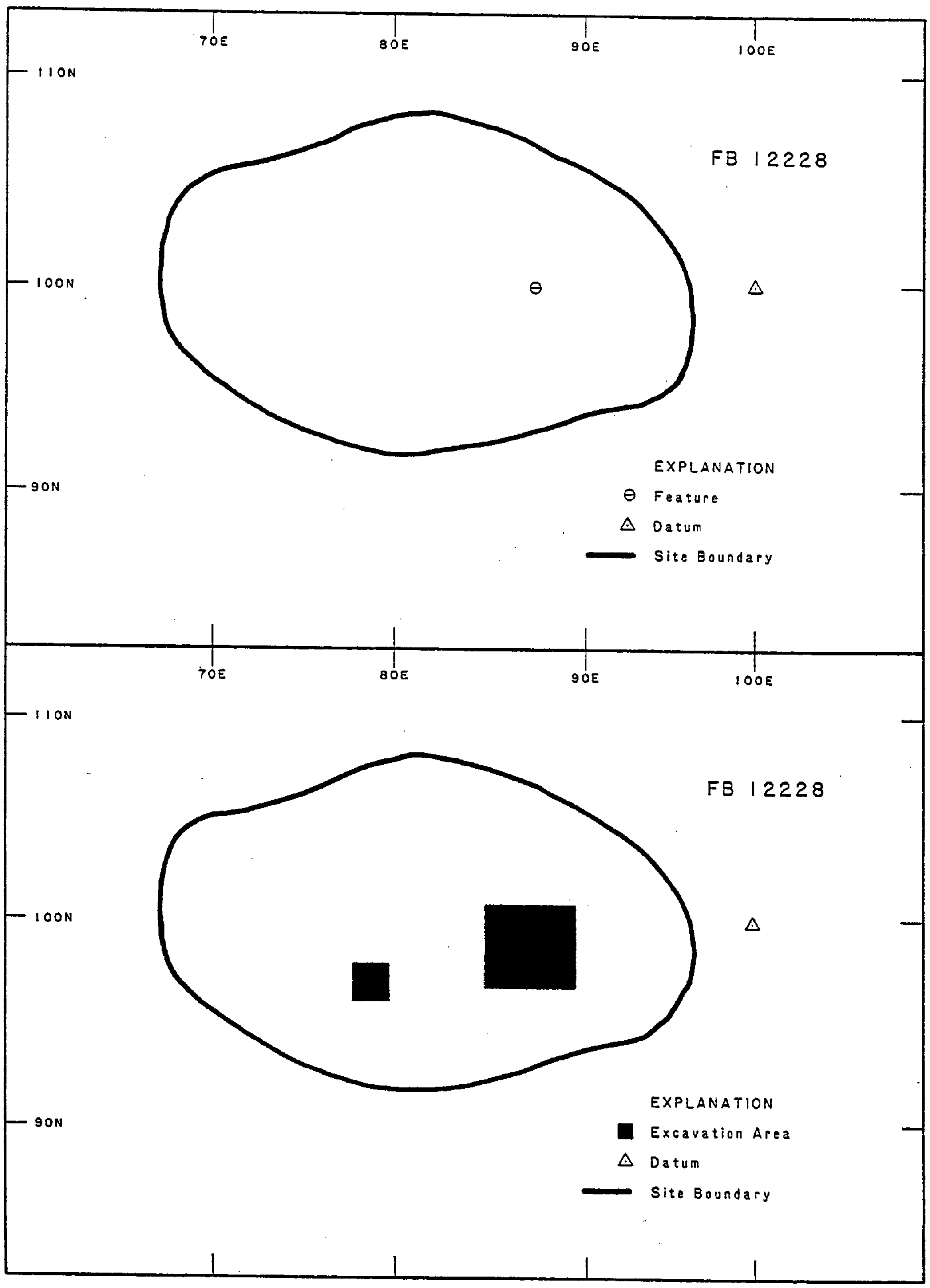
FB12229

Status: 1 (significant data remaining)

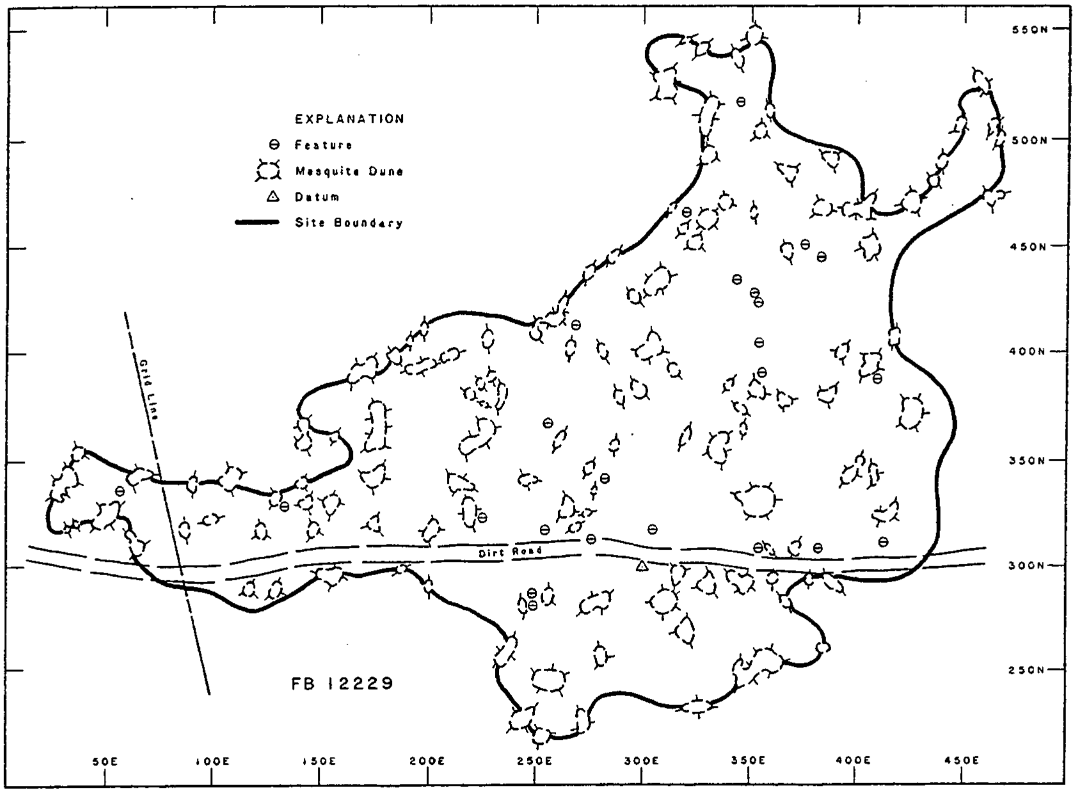
Radiocarbon Dates: None

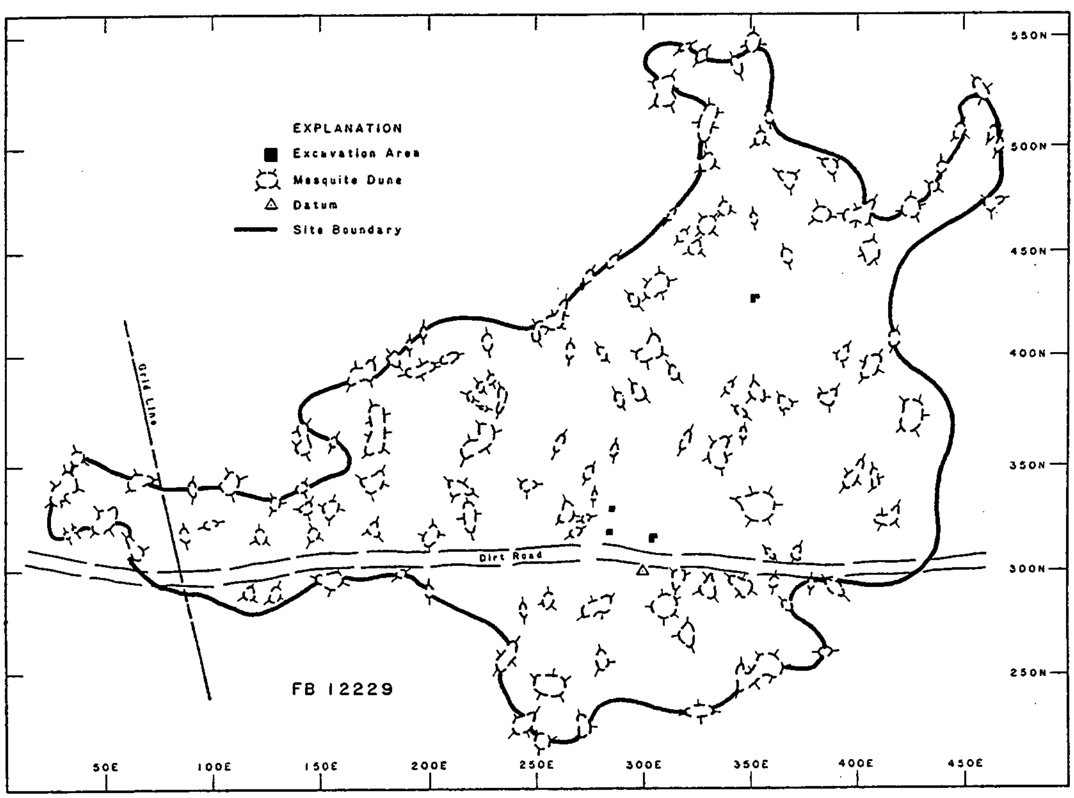
Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-31	363	273	0	4.27	Mesilla phase
				3.49	Mesilla phase
DL-92-32	343	285	0	8.65	Late Archaic
DL-92-33	335	286	0	9.59	Middle Archaic/Late Archaic
DL-92-34	278	310	0	–	–
DL-92-35	279	301	0	–	–
DL-92-36	336	278	0	–	–
DL-92-407	278	310	0	3.19	Mesilla phase
DL-92-408	187	305	0	3.07	Mesilla phase/El Paso phase
				2.20	El Paso phase/Protohistoric
DL-92-409	188	305	0	2.48	El Paso phase/Mesilla phase
DL-92-410	354	427	0	4.74	Mesilla phase/Late Archaic
DL-92-411	360	427	0	5.73	Late Archaic/Mesilla phase
DL-92-412	275	312	0	3.67	Mesilla phase



FB12228. *Top,* site area; *bottom,* excavation area.





FB12229. *Top,* features; *bottom,* excavation areas.

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period
Projectile point	2000 B.C.–A.D. 1150	Late Archaic to Mesilla phase

Size (meters): 59,422

Erosion: Moderate

Modern Disturbance: Moderate

Surface Features : 23

Total Features: 23

Surface Artifacts: 742

Tested Features: 2

Feature Types:

Burned caliche	8
Burned caliche/fire-cracked rock	9
Small stain	6

Square Meters Tested: 16

Subsurface Artifacts: 21

Historic Artifacts: 1 U.S. Penny (A.D.1919)

FB12229 was tested with two block excavations and two 1-by-1-meter judgmentally placed units. These excavations tested two surface features and for subsurface cultural evidence in built-up sands between two surface lithic concentrations. One of the block excavations consisted of a 7-square-meter area over Feature 2 in the east-central portion of the site. The other block was also a 7-square-meter area over Feature 17 in the northeast portion of the site. The two 1-by-1-meter test units were placed in the east-central portion of the site.

No subsurface features were uncovered from the excavations, though a low density of subsurface material was present in all the excavations. Test units revealed subsurface cultural materials under built-up sands at the site. Block excavations did not exhaust the research potential of the site areas tested.

The site still contains significant data as a large portions of the site was not tested. Many surface features remain untested, and the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
2	307	317	Burned caliche with stain	Yes	6
3	255	317	Burned caliche/fire-cracked rock	No	5
4	225	323	Burned caliche/fire-cracked rock	No	3
5	209	318	Burned caliche	No	5
6	57	336	Burned caliche	No	6
7	133	329	Burned caliche	No	3
8	355	307	Burned caliche/fire-cracked rock	No	3
9	383	308	Burned caliche/fire-cracked rock	No	2
10	412	311	Burned caliche/fire-cracked rock	No	1
11	409	389	Small stain <1 meter	No	3
12	345	515	Burned caliche with stain	No	3
13	320	465	Burned caliche	No	4
14	355	391	Burned caliche	No	4
15	354	405	Burned caliche	No	4
16	354	424	Burned caliche/fire-cracked rock	No	3
17	351	429	Fire-cracked rock with stain	Yes	5
18	344	434	Burned caliche/fire-cracked rock	No	4
19	375	450	Small stain <1 meter	No	5
20	383	444	Small stain <1 meter	No	5
21	255	367	Burned caliche	No	5

22	249	281	Small stain <1 meter	No	5
23	268	413	Small stain <1 meter	No	5
24	249	287	Small stain <1 meter	No	5

FB12230

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	4000–2000 B.C.	Middle Archaic

Size (meters): 389

Erosion: Severe — Modern Disturbance: None

Surface Features:	1	Surface Artifacts:	4
Total Features:	1	Tested Features:	1

Feature Types:

Burned caliche/fire-cracked rock	1

Square Meters Tested: 38 — Subsurface Artifacts: 6

A single block excavation established on this site encompassed a 38-square-meter area in the south portion of the site over the surface manifestation of the only feature. No excavations were conducted in association with artifacts collected at the north edge of the site because the surface in this area was extremely deflated.

Excavations found subsurface cultural materials and also uncovered and excavated a portion of a burned caliche concentration. This concentration was against the east edge of the excavation area and extended east into a large mesquite dune.

FB 12230 may still contain significant data. Additional testing is required to assess the research potential of the site.

Feature No.	East	North	Type	Tested	Condition
1	96	78	Burned caliche	Yes	4

FB12231

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts:

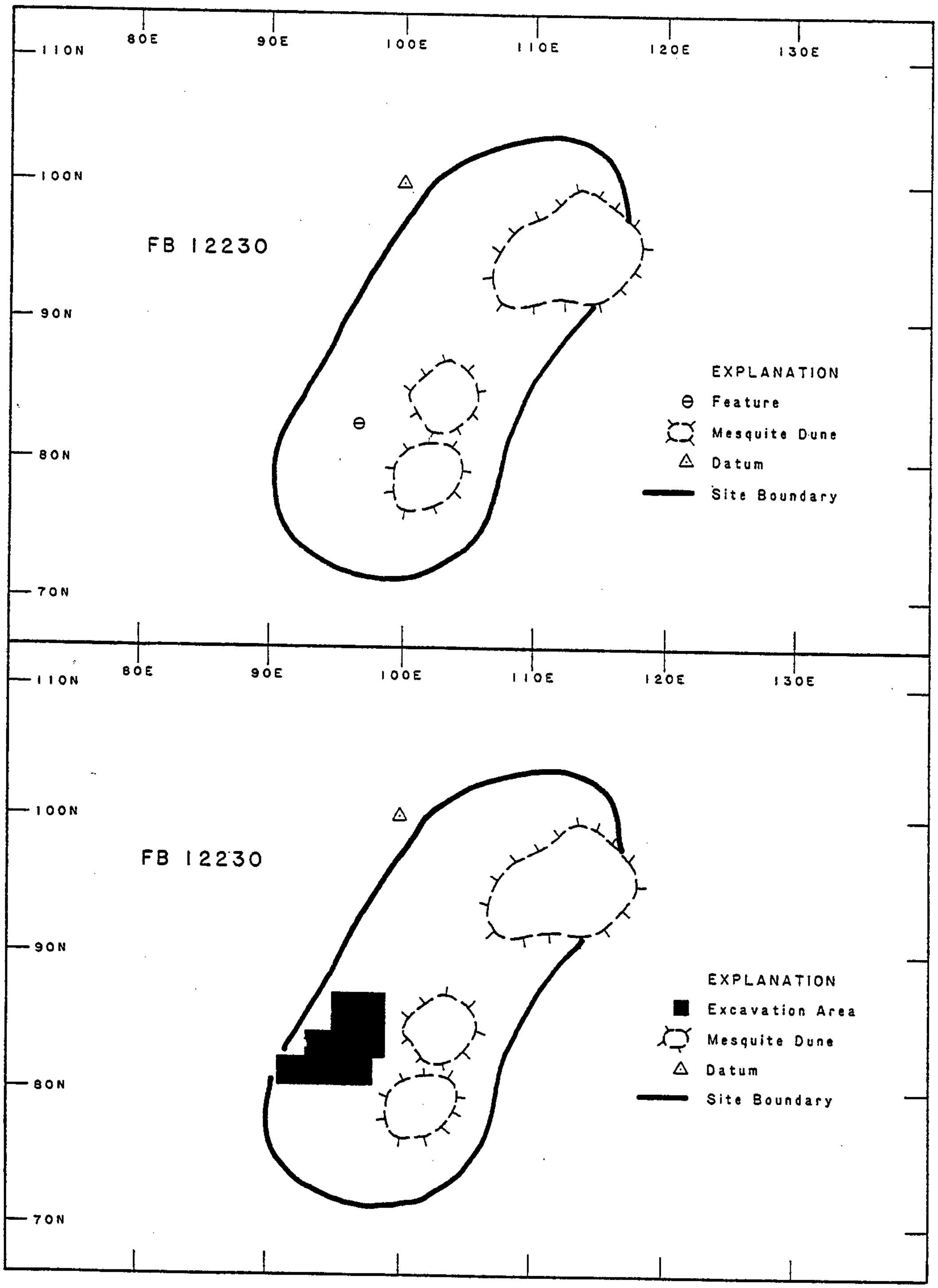
Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 1,249

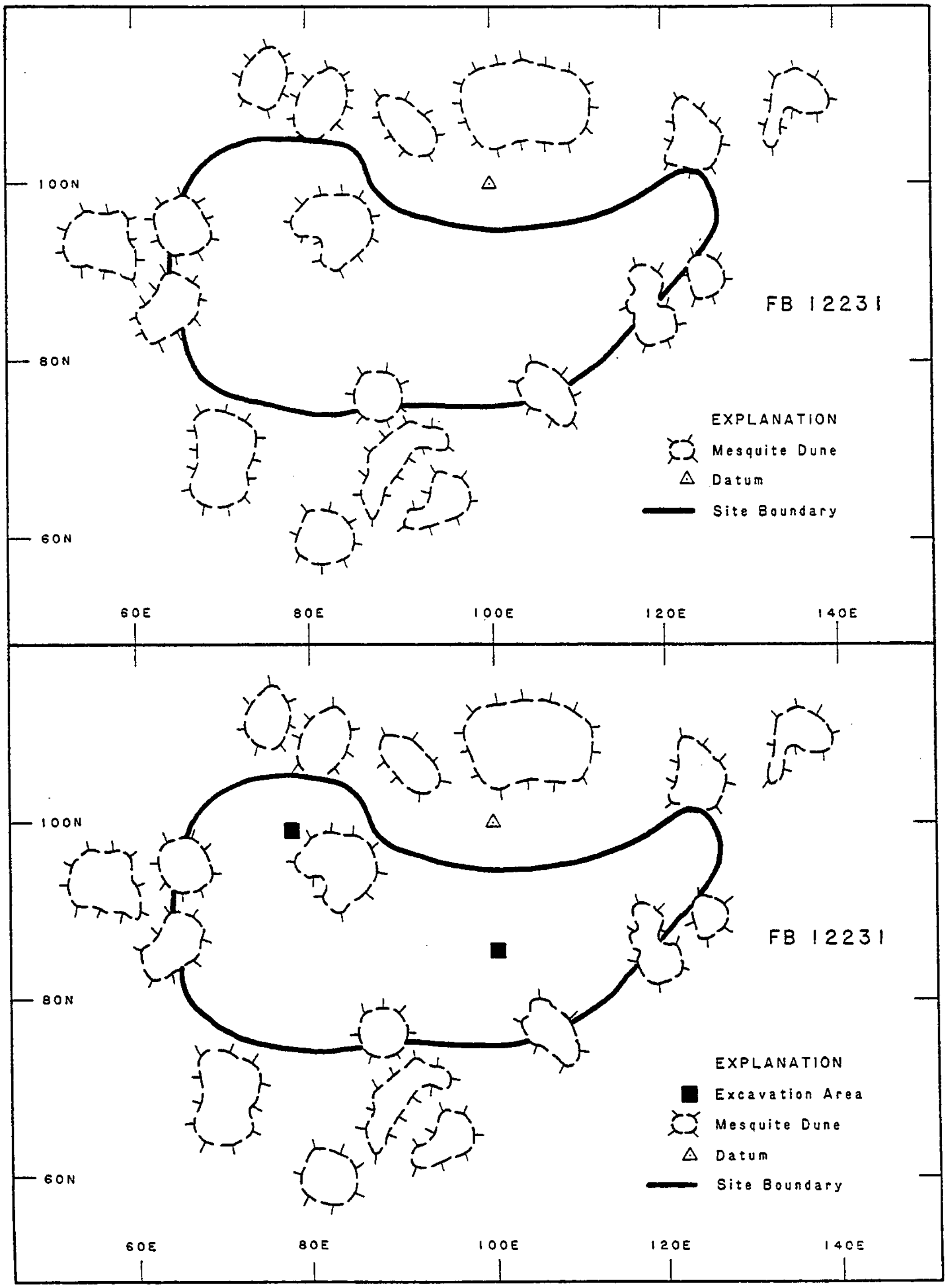
Erosion: Moderate — Modern Disturbance: Moderate

Surface Features:	0	Surface Artifacts:	55
Total Features:	0	Tested Features:	0

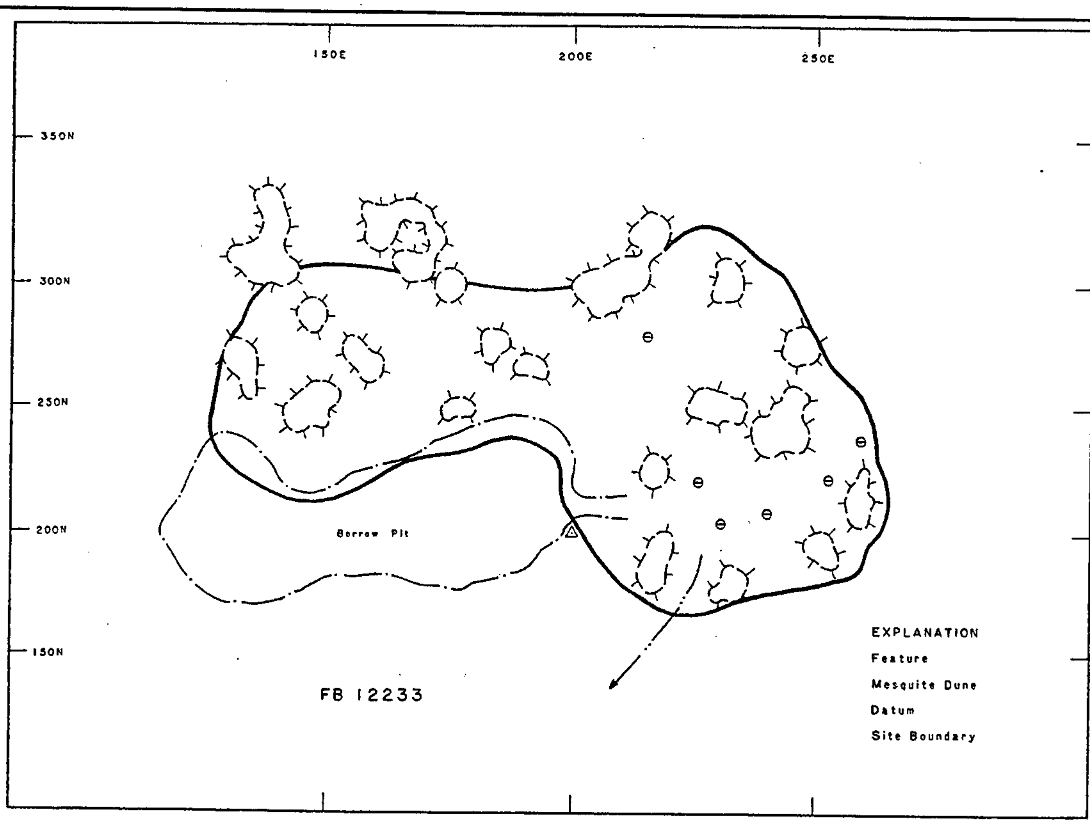
Feature Types: None



FB12230. *Top,* site area; *bottom,* excavation area.



FB12231. *Top,* site area; *bottom,* excavation area.



FB12233 (41EP4915).

Square Meters Tested: 8 Subsurface Artifacts: 9

The site was thought to be mitigated after Phase II. The site lacks features. The initial assessment that the surface of FB12231 was severely deflated. All surface artifacts were collected.

The site was reexamined during Phase III. Additional surface artifacts were collected indicating cultural materials were being exposed. The site was not severely deflated as previously assessed, but only moderately deflated with areas of built-up interdunal and dunal sands. These latter areas bordered the site boundary and separated the site from nearby sites to the southeast and east.

FB12231 was then tested with two 4-square-meter blocks. One was located in the central portion and the other was located in the northwest portion of the site in areas of built-up sands. The excavations uncovered cultural material. FB12231 may still contain significant data. Additional work is required to assess the research potential of the site.

FB12233 (41EP4915)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
*Undifferentiated brownware	A.D. 250-1450	Formative period

(* Whalen 1977, 1980)

Size (meters): 6,460

Erosion:	Moderate	Modern Disturbance:	Severe
Surface Features:	6	Surface Artifacts:	9
Total Features:	6	Tested Features:	0

Feature Types:

Burned caliche	6

Square Meters Tested: 0 Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. The site still contains significant data. No testing of the site area was conducted The surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	216	240	Burned caliche	No	2
2	226	210	Burned caliche	No	5
3	230	202	Burned caliche	No	4
4	239	204	Burned caliche	No	2
5	253	211	Burned caliche	No	3
6	258	219	Burned caliche	No	3

FB12234

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 768

Erosion: Moderate Modern Disturbance: Low

Surface Features:	2	Surface Artifacts:	4
Total Features:	2	Tested Features:	2

Feature Types:

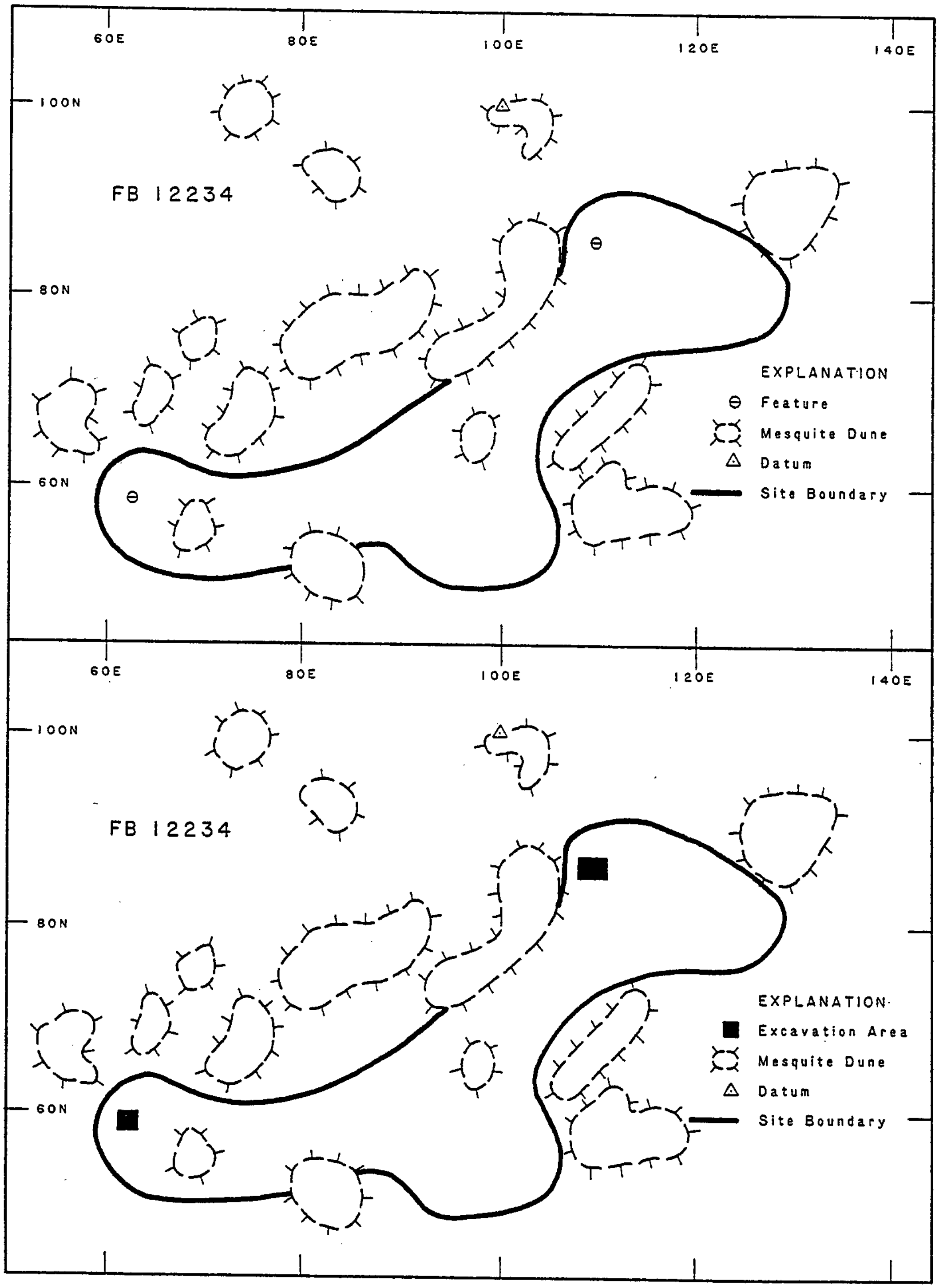
Small stain	2

Square Meters Tested: 10 Subsurface Artifacts: 1

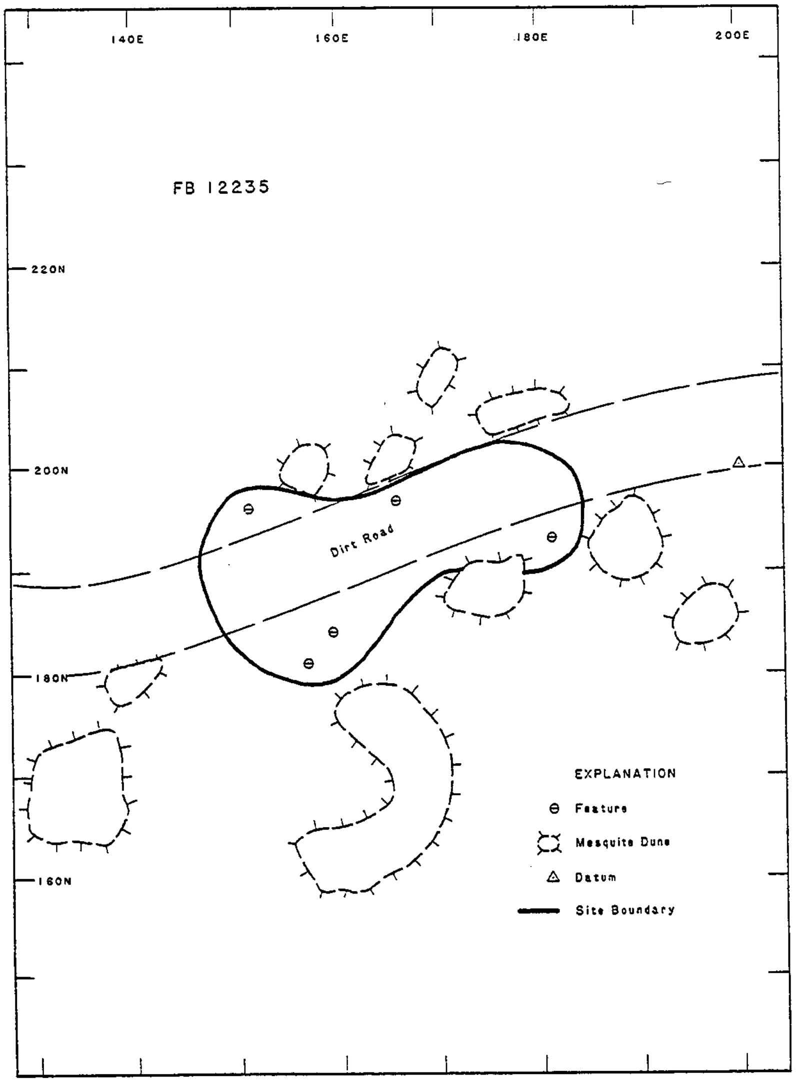
The site was tested with two block excavations placed over the surface features. The largest was 6 square meters over Feature 1 in the east portion of the site. A 4-square-meter area was placed over Feature 2 in the west portion of the site. The block excavation area associated with Feature 2 uncovered no subsurface evidence and revealed Feature 2 to be a modern ash stain. The block associated with Feature 1 revealed subsurface material but did not exhaust the subsurface horizontal extent of this evidence.

FB12234 may still contain significant data. Excavation results associated with the Feature 1 block, the lack of testing in much of the site, and the classification of the surface as moderately deflated suggests that additional work will be required to assess the significance of FB12234.

Feature No.	East	North	Type	Tested	Condition
1	109	86	Small stain <1 meter	Yes	6
2	62	59	Small stain <1 meter	Yes	6



FB12234. *Top,* site area; *bottom,* excavation area.



FB12235 (41EP4916).

FB12235 (41EP4916)

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 675

Erosion: Low		Modern Disturbance: Moderate	
Surface Features:	5	Surface Artifacts:	0
Total Features:	0	Tested Features:	0
Feature Types:			
Burned caliche		5	

Square Meters Tested: 0

Subsurface Artifacts: 0

FB12235 still contains significant data. No testing of the site area was conducted. The five surface features remain untested. The site surface is only minimally deflated.

Feature No.	East	North	Type	Tested	Condition
1	157	181	Burned caliche	No	4
2	159	184	Burned caliche	No	4
3	165	196	Burned caliche	No	5
4	181	193	Burned caliche	No	5
5	151	196	Burned caliche	No	3

FB12237

Status: 2 (requires additional testing)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-413	114	105	1	8.39	Late Archaic
DL-92-414	115	103	1	9.55	Middle Archaic/Late Archaic

Diagnostic Artifacts: None

Size (meters): 549

Erosion: Moderate — Modern Disturbance: Low

Surface Features:	0	Surface Artifacts:	13
Total Features:	1	Tested Features:	1

Feature Types:

Small stain	1

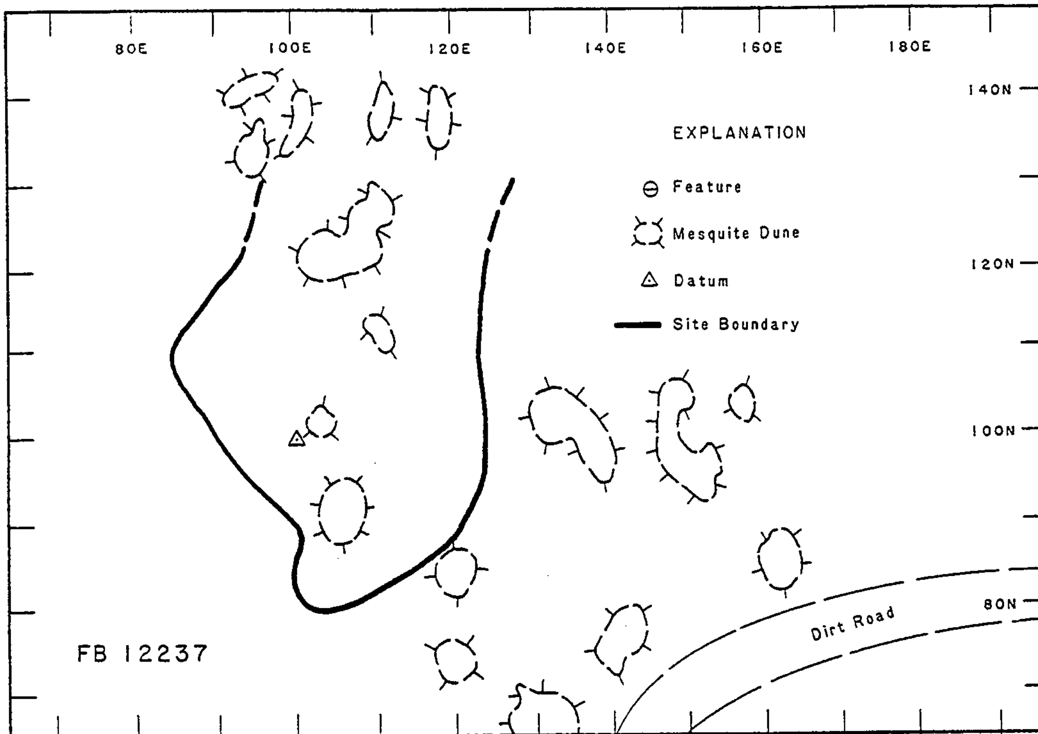
Square Meters Tested: 68 — Subsurface Artifacts: 118

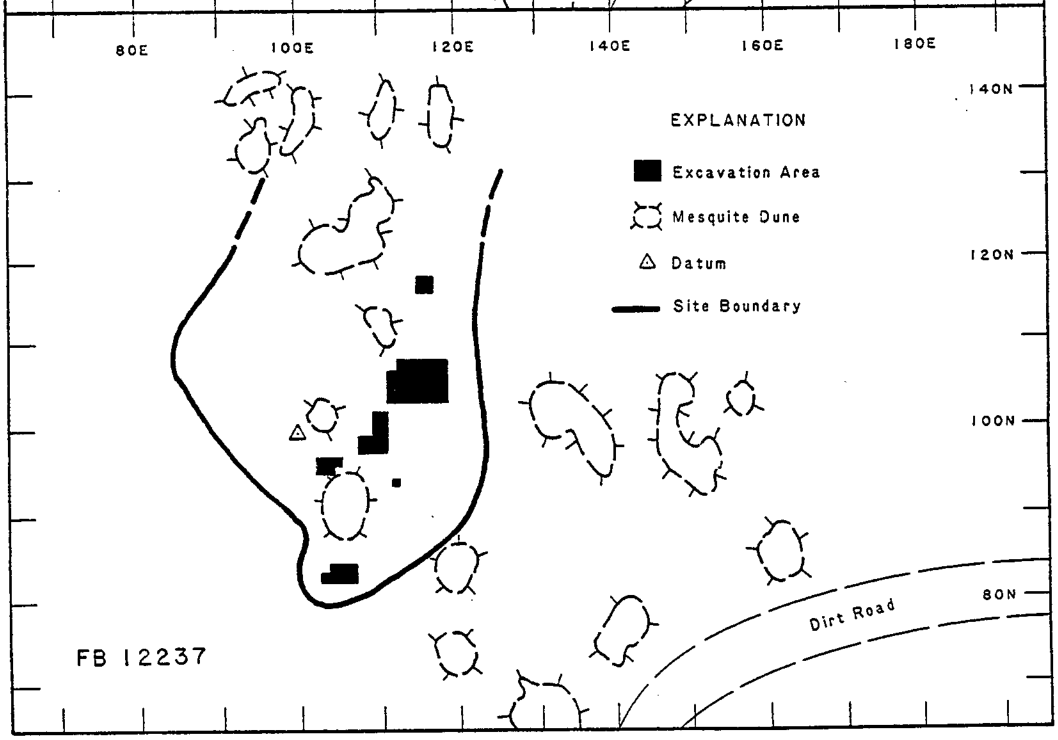
Backhoe Trenches: 1 = 22 square meters

Five block excavations, a 1-by-1-meter unit, and a backhoe trench were established on this site. The largest of the blocks consisted of a 34-square-meter area in the east-central portion of the site. A 17-square-meter block was placed to the southwest of this area where a few lithic artifacts were found on the surface. Five square meters were placed to the southwest of the latter area where a few additional surface lithic artifacts were found. Seven square meters were excavated at the south edge of the site where a few scattered surface burned caliche and fire-cracked rock pieces were present. Four square meters were placed against the north edge of the site where a few surface lithic artifacts were found. The single 1-by-1-meter unit was placed in the south portion of the site on the east leading edge of a mesquite dune. The single backhoe trench was excavated in the northwest portion of the site and extended to the west of the site.

Additional surface artifacts were collected, indicating cultural materials are being exposed. All block excavations uncovered subsurface material and the northern block uncovered an ash stain feature with a corresponding cultural horizon. This northern block also uncovered materials from three separate soil horizons. The excavations did not exhaust the research potential of the site. The additional surface artifacts collected and the excavations expanded the site boundary to the north.

FB12237 may still contain significant data given the excavation results. Not all areas of the site have been tested and cultural materials are being exposed. The site is only moderately deflated. Additional testing is required to assess the significance of FB12237.





FB12237. *Top,* site area; *bottom,* excavation area.

FB12239

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-38	403	264	0	7.00	Late Archaic
				4.14	Mesilla phase

Diagnostic Artifacts: None

Size (meters): 16,551

Erosion: Severe　　Modern Disturbance: Severe

Surface Features: 10　　Surface Artifacts: 134
Total Features: 10　　Tested Features: 1
Feature Types:

Burned caliche	4
Burned caliche/fire-cracked rock	6

Square Meters Tested: 16　　Subsurface Artifacts: 27

One block excavation tested a 16-square-meter area over Feature 7 in the northeast portion of the site.

Additional surface artifacts were collected during Phase III indicating cultural materials were being exposed. The block excavation uncovered subsurface cultural materials and did not exhaust the research potential of these materials.

FB12239 still contains significant data. Cultural materials are being exposed and the majority of surface features remain untested.

Feature No.	East	North	Type	Tested	Condition
1	311	172	Burned caliche/fire-cracked rock	No	5
2	316	178	Burned caliche	No	3
3	321	182	Burned caliche	No	4
4	334	299	Burned caliche/fire-cracked rock	No	2
5	344	324	Burned caliche	No	3
6	354	326	Burned caliche/fire-cracked rock	No	3
7	398	338	Burned caliche/fire-cracked rock	Yes	5
8	325	352	Burned caliche/fire-cracked rock	No	3
9	279	317	Burned caliche/fire-cracked rock	No	3
10	324	307	Burned caliche	No	4

FB12240

Status: 3 (no significant data remaining)

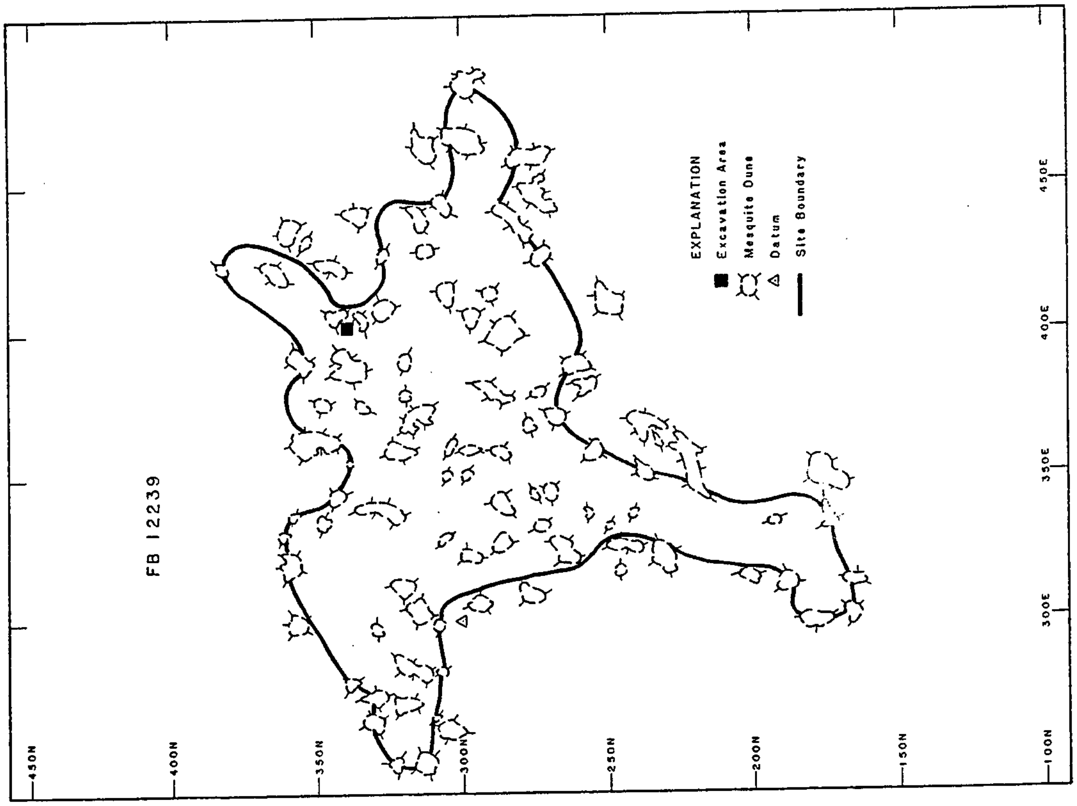
Radiocarbon Dates: None

Diagnostic Artifacts: None

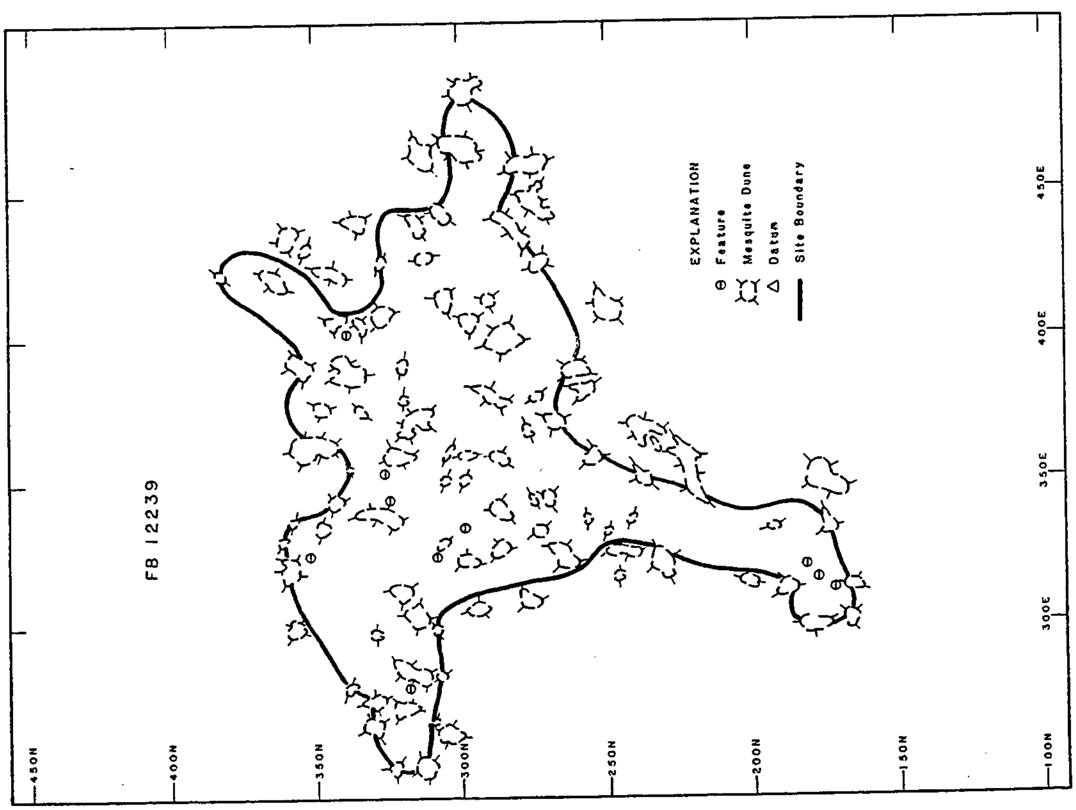
Size (meters): 1,225

Erosion: Severe　　Modern Disturbance: Severe

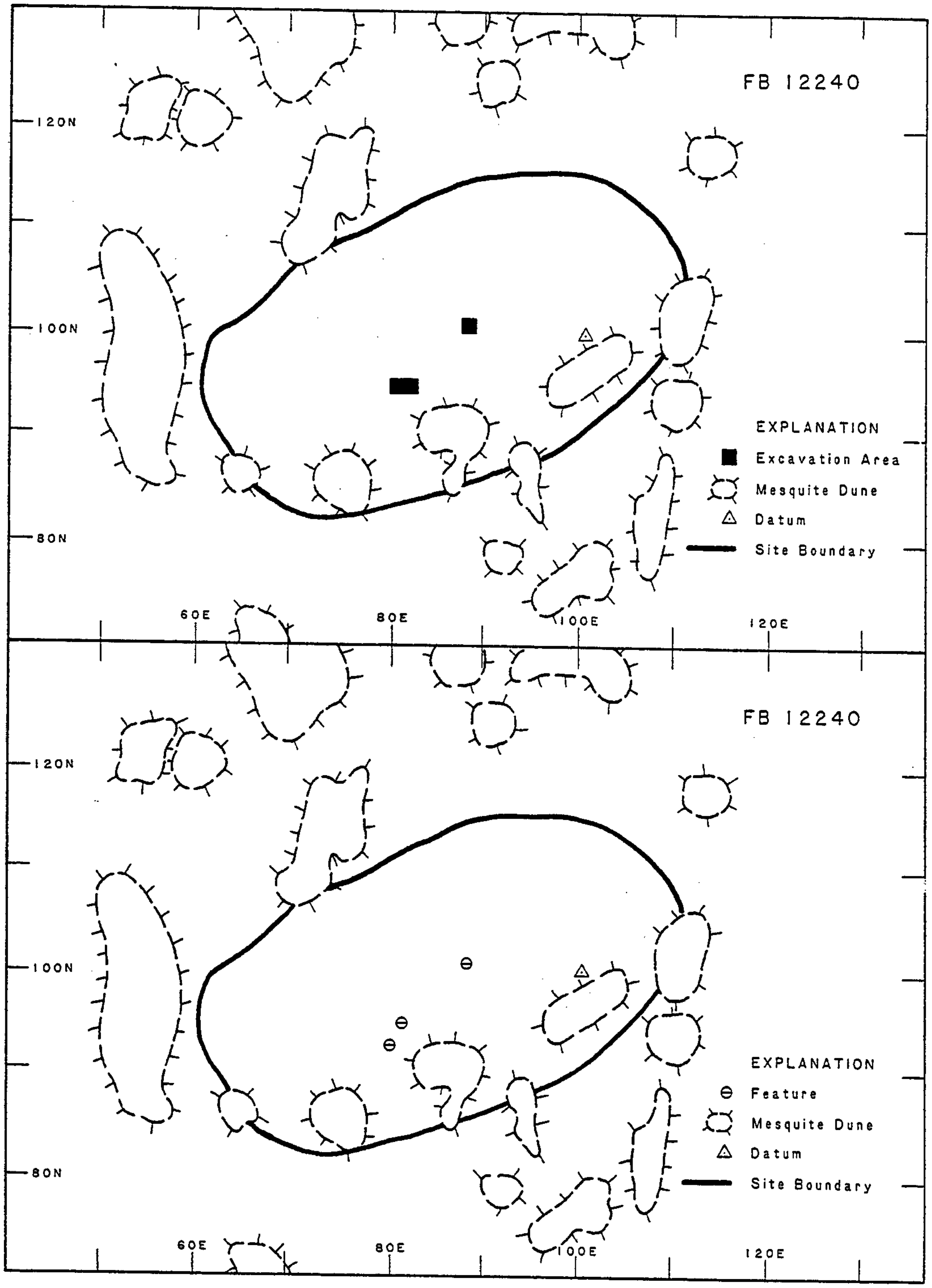
Surface Features: 3　　Surface Artifacts: 12



FB12239, Excavation Areas.



FB12239, Features.



FB12240. *Top,* site area; *bottom,* excavation area.

Total Features: 3   Tested Features: 2

Feature Types:

Small stain 3

Square Meters Tested: 10   Subsurface Artifacts: 1

Surface features were tested in two block excavations except Feature 1, which was a small modern stain. A 6-square-meter block was excavated over Feature 2. A 4-square-meter block was placed over Feature 3. These blocks were placed in the central portion of the site.

The site was revisited during Phase III of the project to verify the lack of additional surface cultural evidence, complete excavations on Feature 2, and reassess the surface erosion. Previous assessments were determined to be correct and no additional surface cultural evidence was present. Excavations revealed Feature 3 was a modern ash stain. Few artifacts were associated with Feature 2.

No subsurface features or concentrations of cultural materials were uncovered during the excavations. The site contains no additional research potential as all surface artifacts were collected, features were excavated, and the surface of the site is severely deflated.

Feature No.	East	North	Type	Tested	Condition
1	80	91	Small stain <1 meter	No	3
2	82	93	Small stain <1 meter	Yes	6
3	90	101	Small stain <1 meter	Yes	6

FB12241

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 3,075

Erosion: Moderate   Modern Disturbance: Low

Surface Features: 4   Surface Artifacts: 17

Total Features: 4   Tested Features: 0

Feature Types:

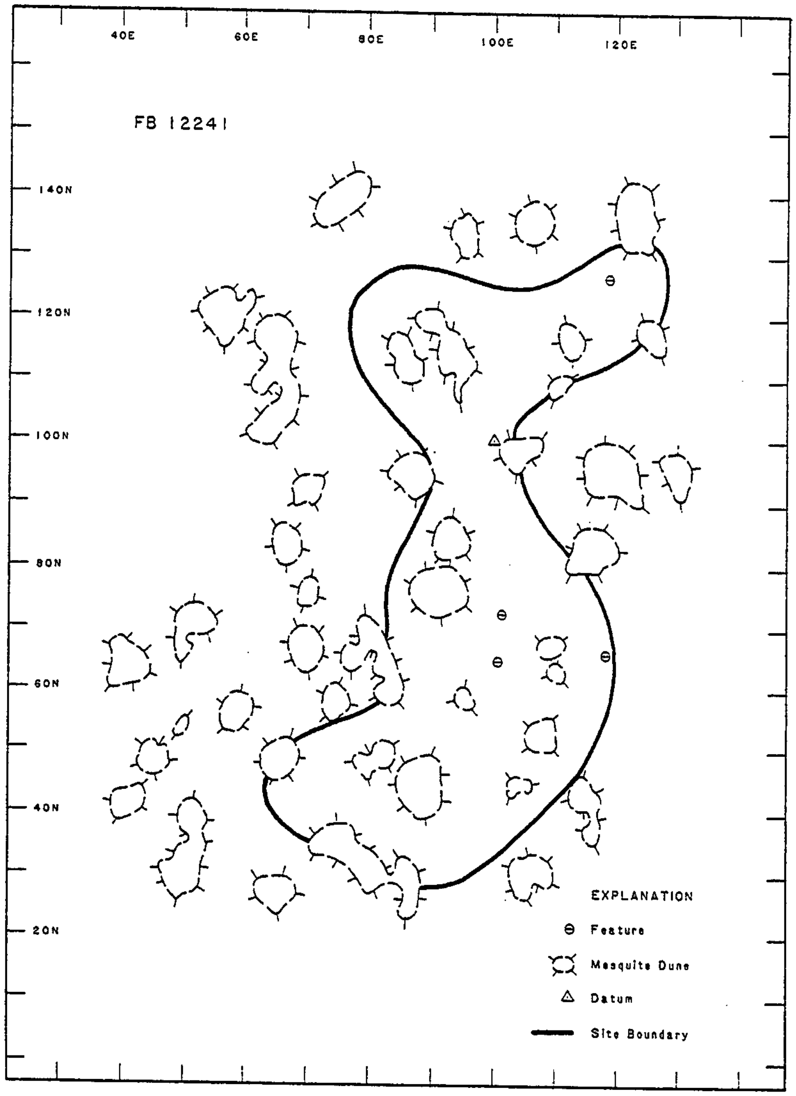
Burned caliche 3

Small stain 1

Square Meters Tested: 0   Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. The site still contains significant data. No testing of the site area was conducted. The surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	101	73	Burned caliche	No	5
2	101	66	Burned caliche	No	5
3	118	124	Burned caliche	No	4
4	118	67	Small stain <1 meter	No	5



FB12241.

FB12243

Status: 1 (significant data remaining)

Radiocarbon Dates:

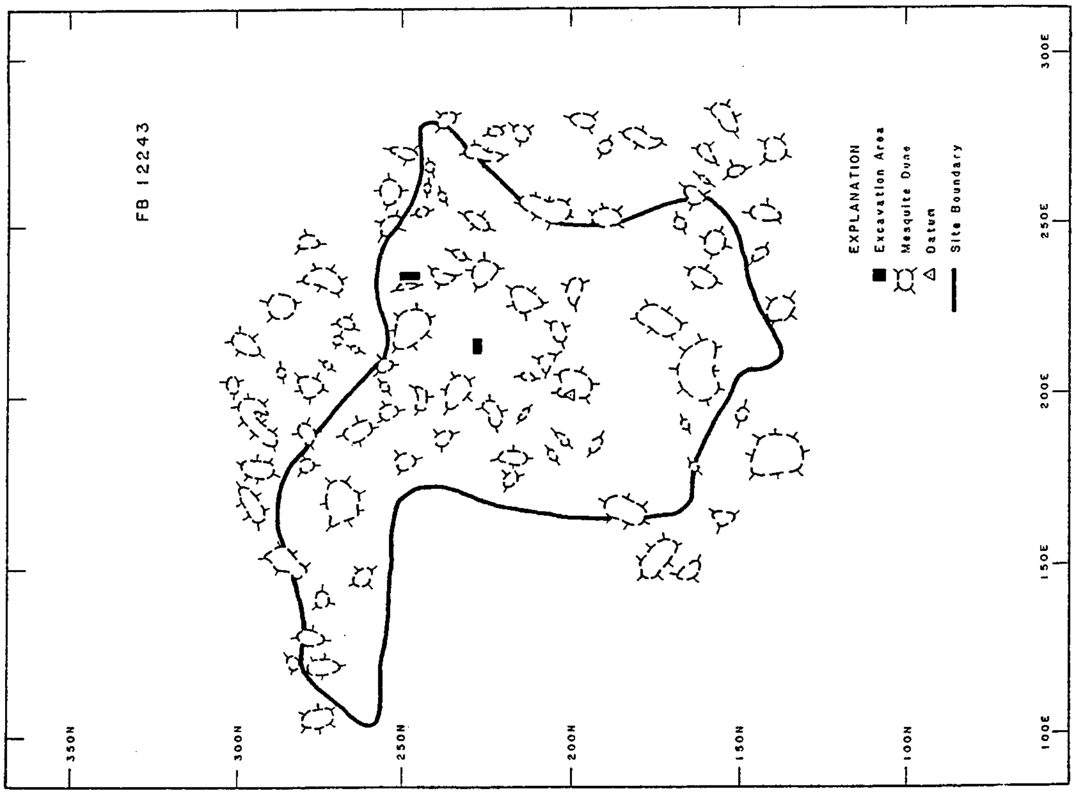
Beta #	Feature #	Date	Corrected Date	Time Period
43213	1	2710 ± 60	1010–790 B.C.	Late Archaic

Obsidian Hydration Rim Measurements and Dates:

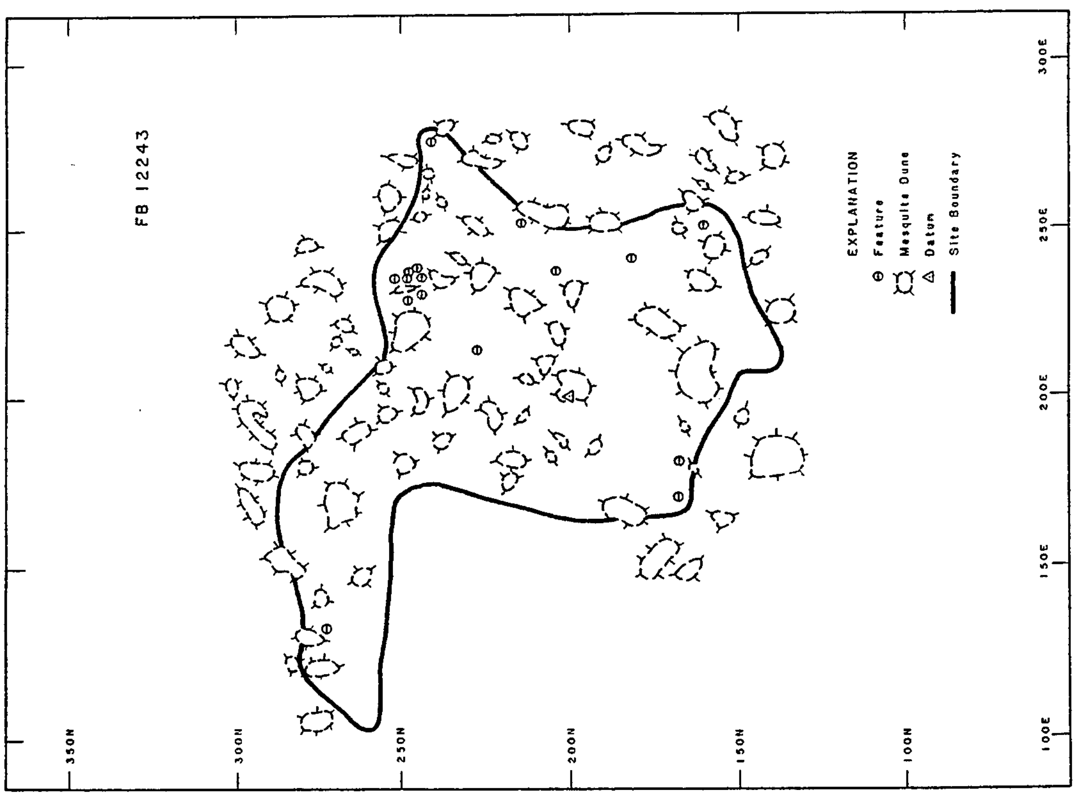
Lab #	East	North	Level	Rim Width	Time Period
DL-92-415	133	266	0	3.15	Mesilla phase/El Paso phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownwares	A.D. 250–1450	Formative period



FB12243, Excavation Areas.



FB12243, Features.

Size (meters): 12,020

Erosion: Moderate | Modern Disturbance: Moderate

Surface Features:	16	Surface Artifacts:	45
Total Features:	17	Tested Features:	4

Feature Types:

Burned caliche	9
Burned caliche/fire-cracked rock	6
Small stain	2

Square Meters Tested: 18 | Subsurface Artifacts: 5

Two block excavations tested a few of the identified surface features. The largest of the block excavations consisted of a 10-square-meter area in the northeast portion of the site over Features 4, 8, and a slight portion of 5. The other block was an 8-square-meter area in the north-central portion of the site over Feature 1.

The block excavations uncovered one subsurface feature and subsurface cultural materials and did not exhaust the subsurface cultural evidence. The site still contains significant data as many surface features have not been tested and the surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	213	228	Burned caliche with stain	Yes	6
2	228	249	Burned caliche	No	5
3	230	245	Burned caliche/fire-cracked rock	No	5
4	235	252	Burned caliche with stain	Yes	5
5	237	248	Burned caliche	No	5
6	238	246	Burned caliche	No	5
7	235	245	Burned caliche	No	4
8	235	249	Burned caliche/fire-cracked rock	Yes	6
9	276	241	Burned caliche	No	3
10	252	215	Burned caliche/fire-cracked rock	No	5
11	237	204	Burned caliche	No	6
12	241	181	Burned caliche	No	5
13	251	160	Burned caliche	No	6
14	132	273	Burned caliche/fire-cracked rock	No	3
15	181	167	Small stain <1 meter	No	4
16	171	167	Small stain <1 meter	No	4

FB12245

Status: 1 (significant data remaining)

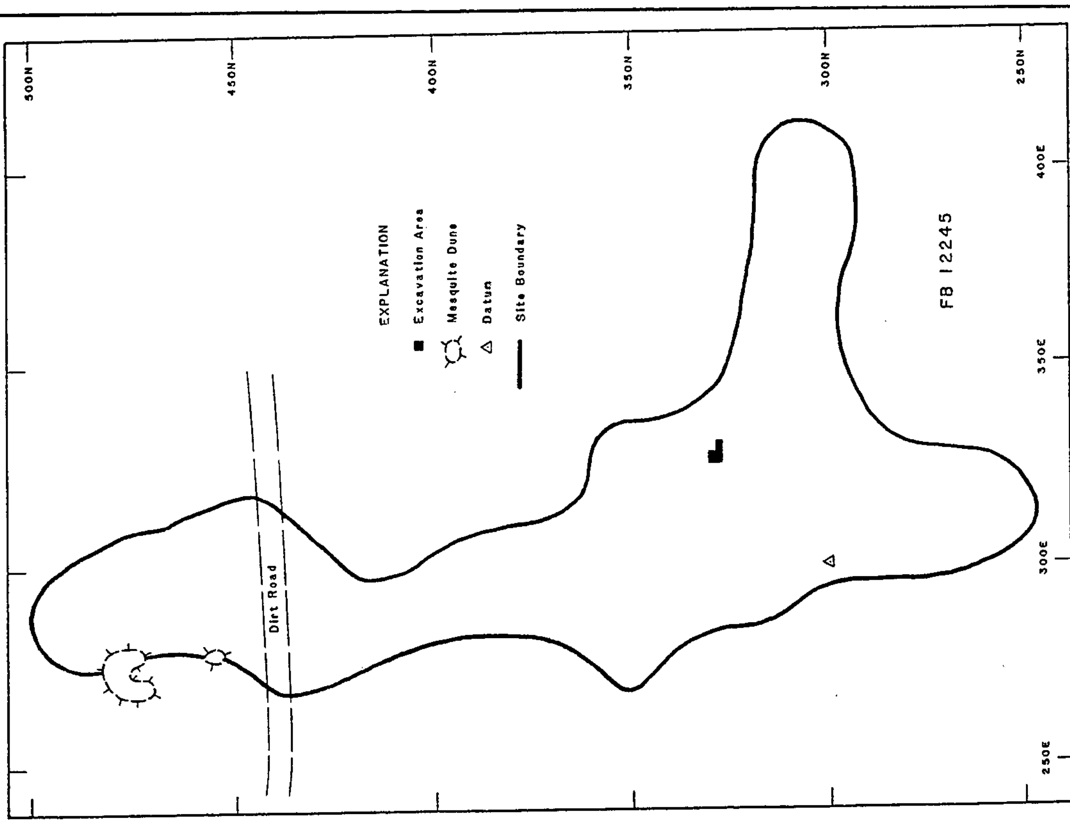
Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

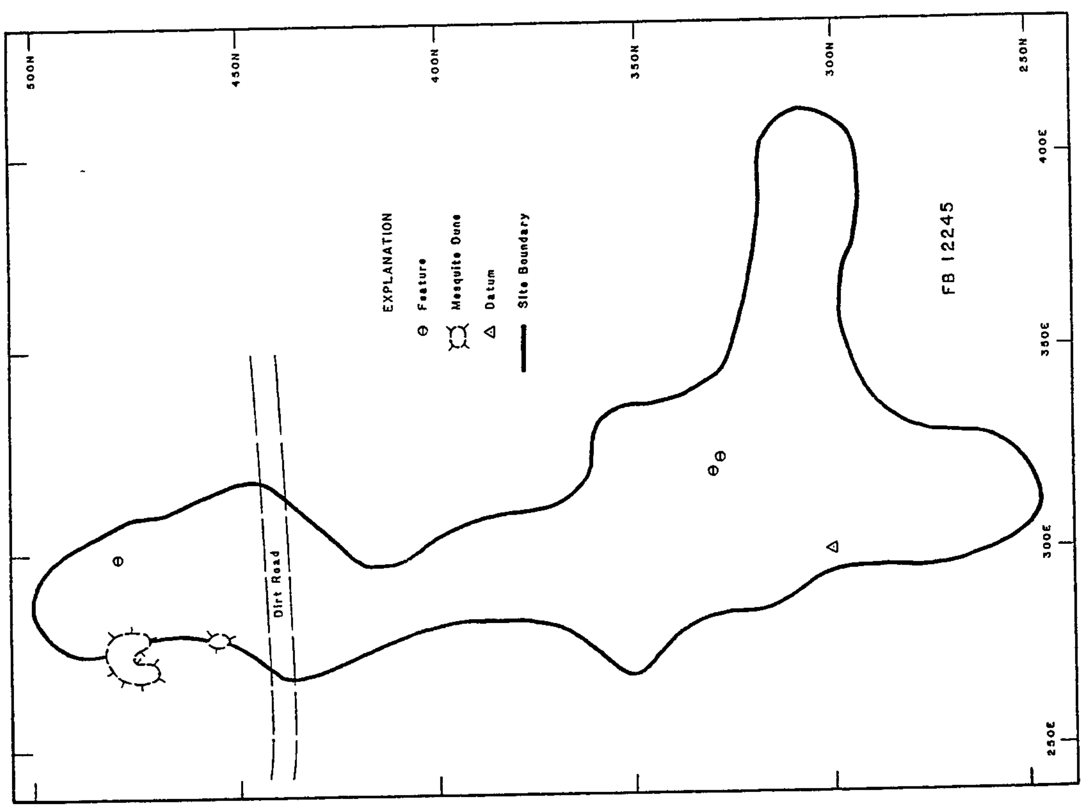
Lab #	East	North	Level	Rim Width	Time Period
DL-92-43	276	466	0	3.46	Mesilla phase

Diagnostic Artifacts: None

Size (meters): 12,382



FB12245, Excavation Areas.



FB12245, Features.

Erosion: Moderate

Modern Disturbance: Moderate

Surface Features:	3	Surface Artifacts:	73
Total Features:	3	Tested Features:	1

Feature Types:

Burned caliche	2
Burned caliche/fire-cracked rock	1

Square Meters Tested: 12

Subsurface Artifacts: 38

The site was tested with a single 9-square-meter block excavation and an adjacent 1-by-3 meter west-to-east, hand excavated trench in the southern portion of the site over Feature 1. Excavation uncovered an intact portion of Feature 1 and subsurface cultural materials and did not exhaust the cultural evidence.

The site still contains significant data as two of the surface features were not tested and the site is only moderately deflated. The sites surface was initially assessed to be severely deflated, though this was inaccurate.

Feature No.	East	North	Type	Tested	Condition
1	328	327	Burned caliche	Yes	3
2	320	330	Burned caliche	No	5
3	299	479	Burned caliche	No	4

FB12246

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1

Erosion: Severe

Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	0

Feature Types:

Small stain	1

Square Meters Tested: 0

Subsurface Artifacts: 0

FB12246 consisted of a small stain in a deflated interdunal area during Phase II. Visits to the site during Phase III revealed the stain was no longer present. The ash stain was probably modern with minimal vertical depth. No excavations were conducted during Phase III.

The site is mitigated. The stain was the only cultural manifestation at the site.

Feature No.	East	North	Type	Tested	Condition
1	106	109	Small stain <1 meter	No	3

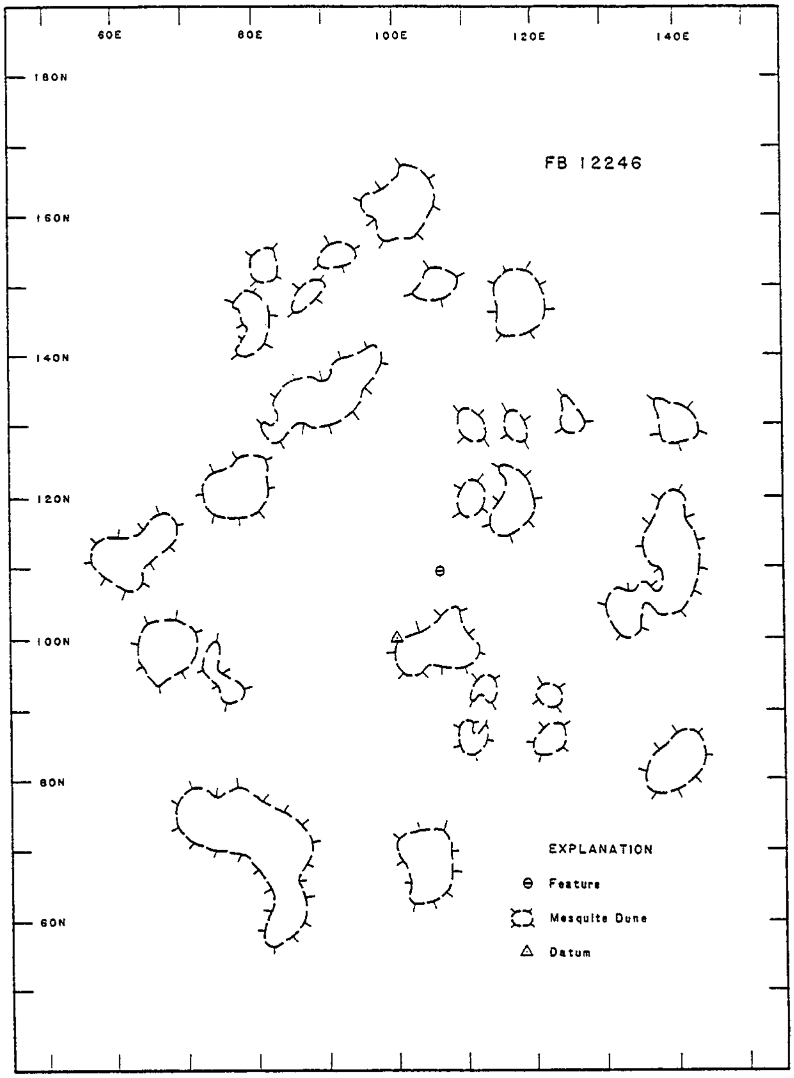
FB12247

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period



FB12246.

DL-92-41	257	253	0	4.31	Mesilla phase
				3.42	Mesilla phase
DL-92-416	273	337	0	3.44	Mesilla phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownwares	A.D. 250–1450	Formative period

Size (meters): 30,884

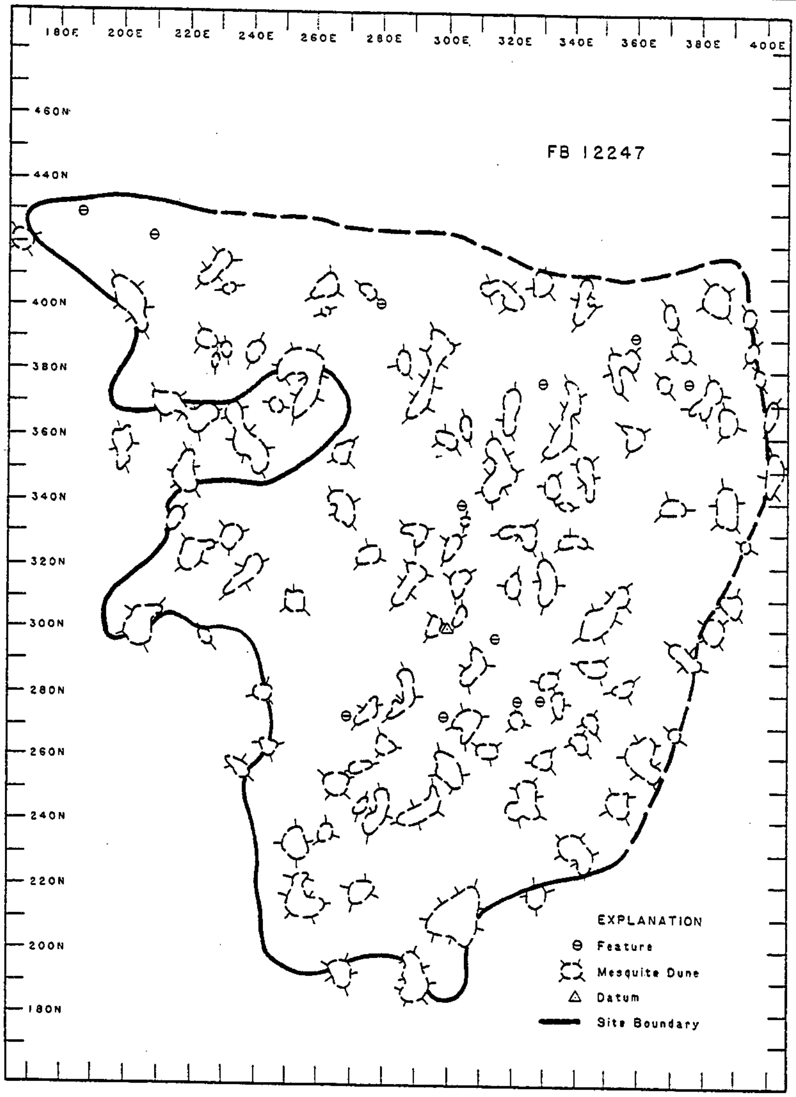
Erosion: Moderate

Modern Disturbance: Low

Surface Features:	12	Surface Artifacts:	121
Total Features:	12	Tested Features:	0

Feature Types:

Burned caliche	3
Burned caliche/fire-cracked rock	7
Small stain	2



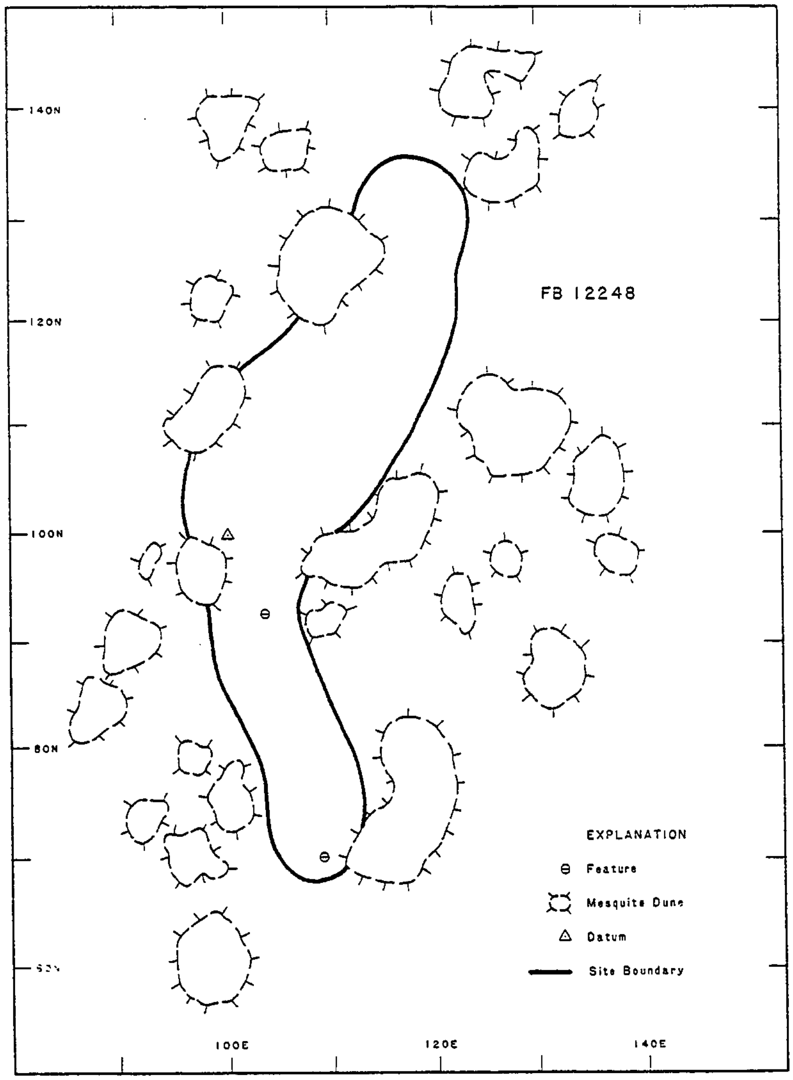
FB12247.

Square Meters Tested: 0

Subsurface Artifacts: 0

All surface artifacts were collected during Phase II. FB12247 still contains significant data. No testing of the site area was conducted. The features of the site remain untested. The surface of the site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	304	339	Burned caliche	No	4
2	315	297	Burned caliche/fire-cracked rock	No	4
3	299	272	Burned caliche/fire-cracked rock	No	5
4	269	272	Burned caliche/fire-cracked rock	No	4
5	329	277	Burned caliche	No	3
6	322	277	Burned caliche	No	4
7	375	377	Burned caliche/fire-cracked rock	No	3
8	359	391	Burned caliche/fire-cracked rock	No	3
9	329	377	Burned caliche/fire-cracked rock	No	4
10	379	401	Burned caliche/fire-cracked rock	No	4
11	375	209	Small stain <1 meter	No	5
12	187	430	Small stain <1 meter	No	3



FB12248.

FB12248

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

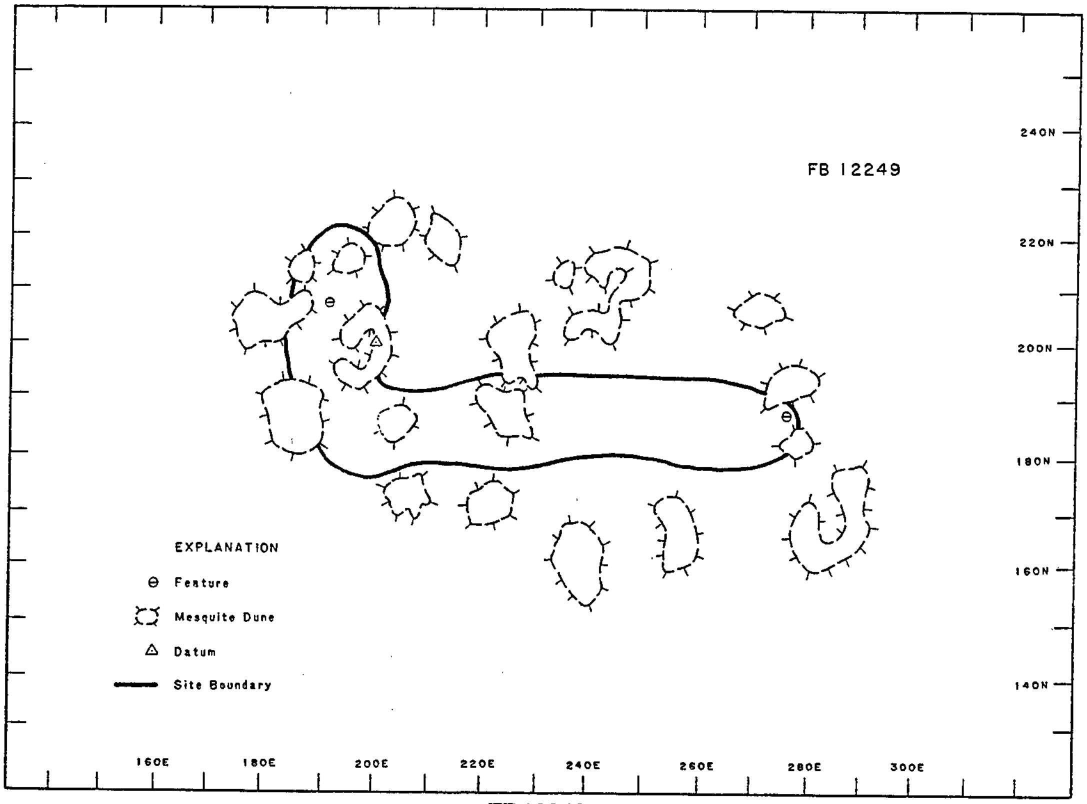
Artifact Type	Probable Date	Time Period
El Paso Brown rim	A.D. 250–1150	Mesilla phase

Size (meters): 937

Erosion: Moderate

Modern Disturbance: Low

Surface Features:	2	Surface Artifacts:	46
Total Features:	2	Tested Features:	0
Feature Types:			



FB12249.

Small stain 2

Square Meters Tested: 0 Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. FB12248 still contains significant data. No testing of the site area was conducted. The two features of this site remain untested. The surface of this site is only moderately deflated.

Feature No.	East	North	Type	Tested	Condition
1	109	70	Small stain <1 meter	No	5
2	104	93	Small stain <1 meter	No	5

FB12249

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

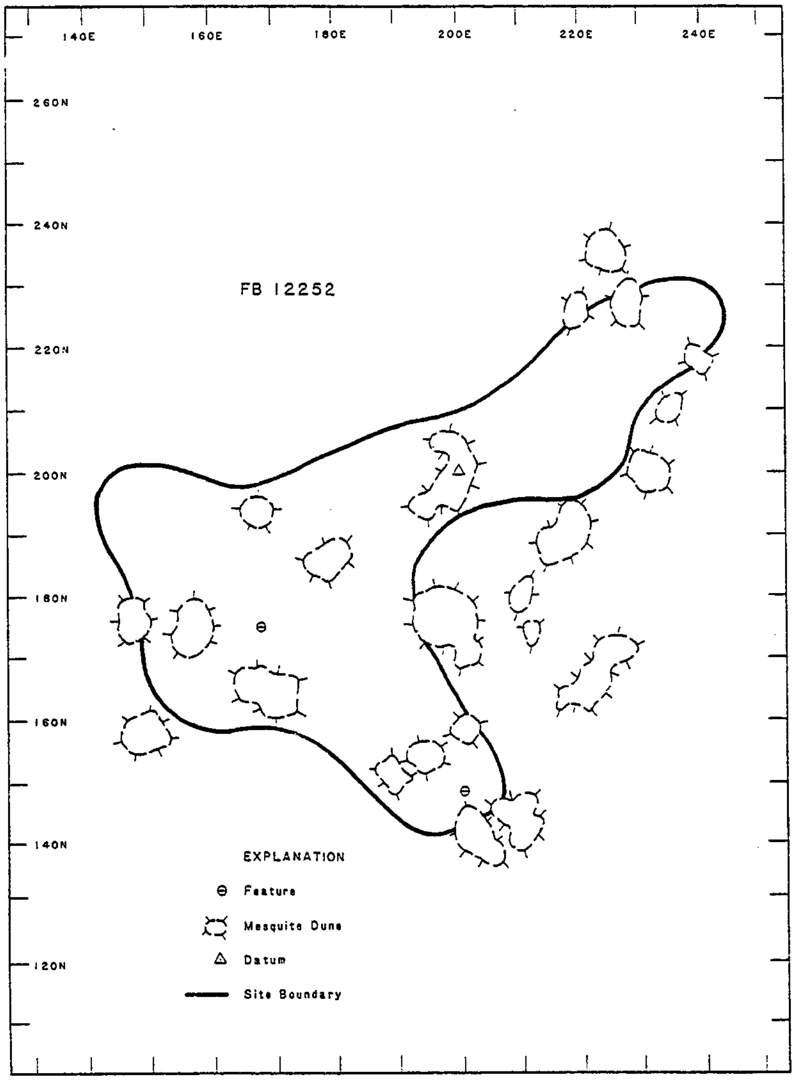
Size (meters): 1,666

Erosion: Low Modern Disturbance: Low

Surface Features: 2 Surface Artifacts: 14
Total Features: 2 Tested Features: 0
Feature Types:

Burned caliche 1
Small stain 1

Square Meters Tested: 0 Subsurface Artifacts: 0



FB12252.

All surface artifacts were collected during Phase II of the project. FB12249 still contains significant data. No testing of the site area was conducted. The two features remain untested. The surface of the site is only minimally deflated.

Feature No.	East	North	Type	Tested	Condition
1	275	187	Burned caliche	No	5
2	191	207	Small stain <1 meter	No	5

FB12252

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 3,344

Erosion: Low		Modern Disturbance: Low	
Surface Features:	2	Surface Artifacts:	9
Total Features:	2	Tested Features:	0

Feature Types:

Burned caliche	1
Small stain	1

Square Meters Tested: 0 Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. FB12252 still contains significant data. No testing has been conducted on the site. Two untested features remain. The surface of the site is only minimally deflated.

Feature No.	East	North	Type	Tested	Condition
1	167	175	Burned caliche	No	5
2	200	148	Small stain <1 meter	No	3

FB12253

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 48

Erosion: Severe		Modern Disturbance: Moderate	
Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	1

Feature Types:

Small stain	1

Square Meters Tested: 9 Subsurface Artifacts: 0

The site consisted of a series of small ash stains in a single deflated interdunal area. A 9-square-meter block excavation was placed over these stains. The excavation revealed the ash stains to be modern. The site contained no prehistoric cultural evidence. Excavations mitigated the site.

Feature No.	East	North	Type	Tested	Condition
1	91	97	Stain (modern)	Yes	6

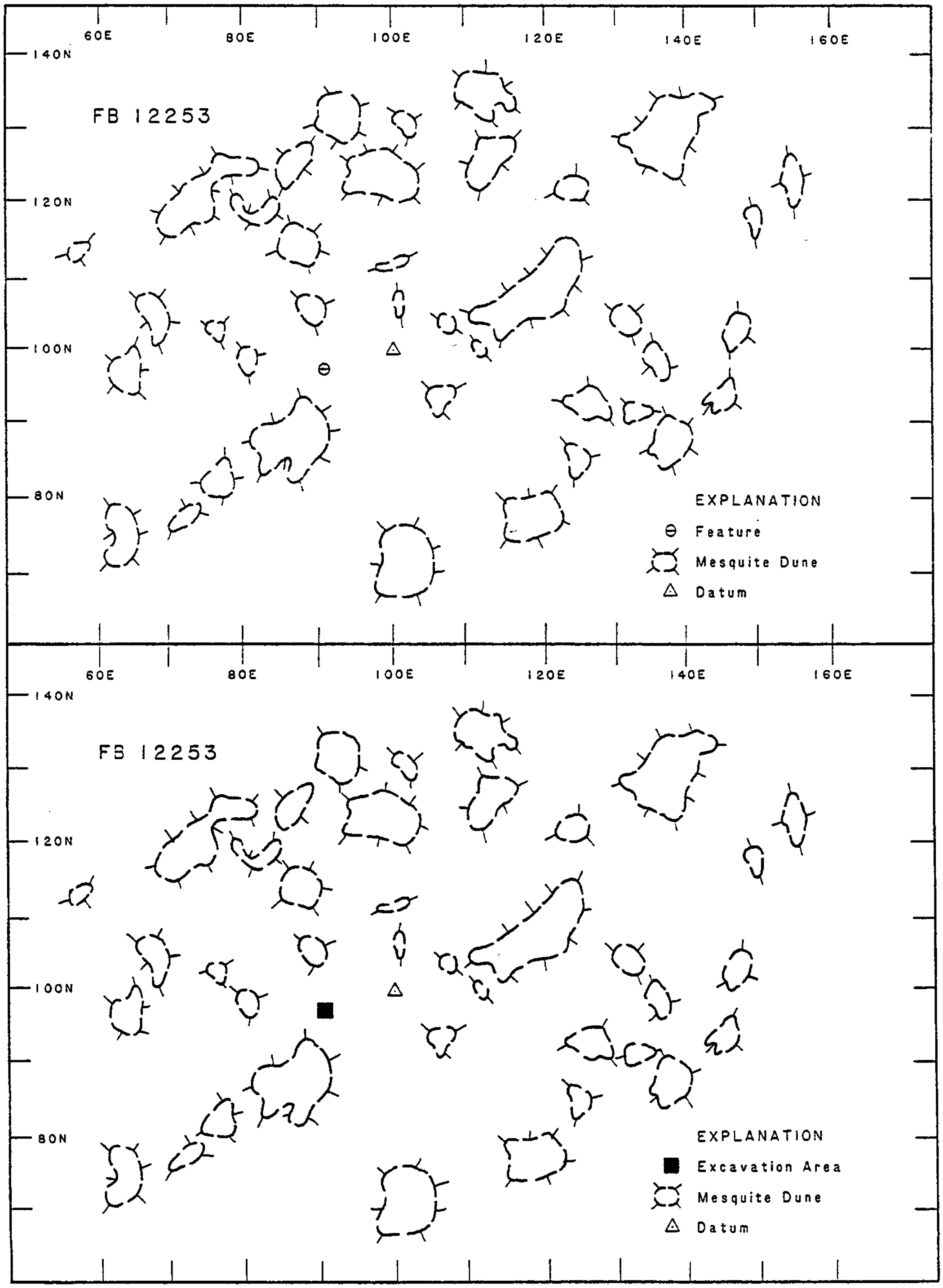
FB12254

Status: 3 (no significant data remaining)

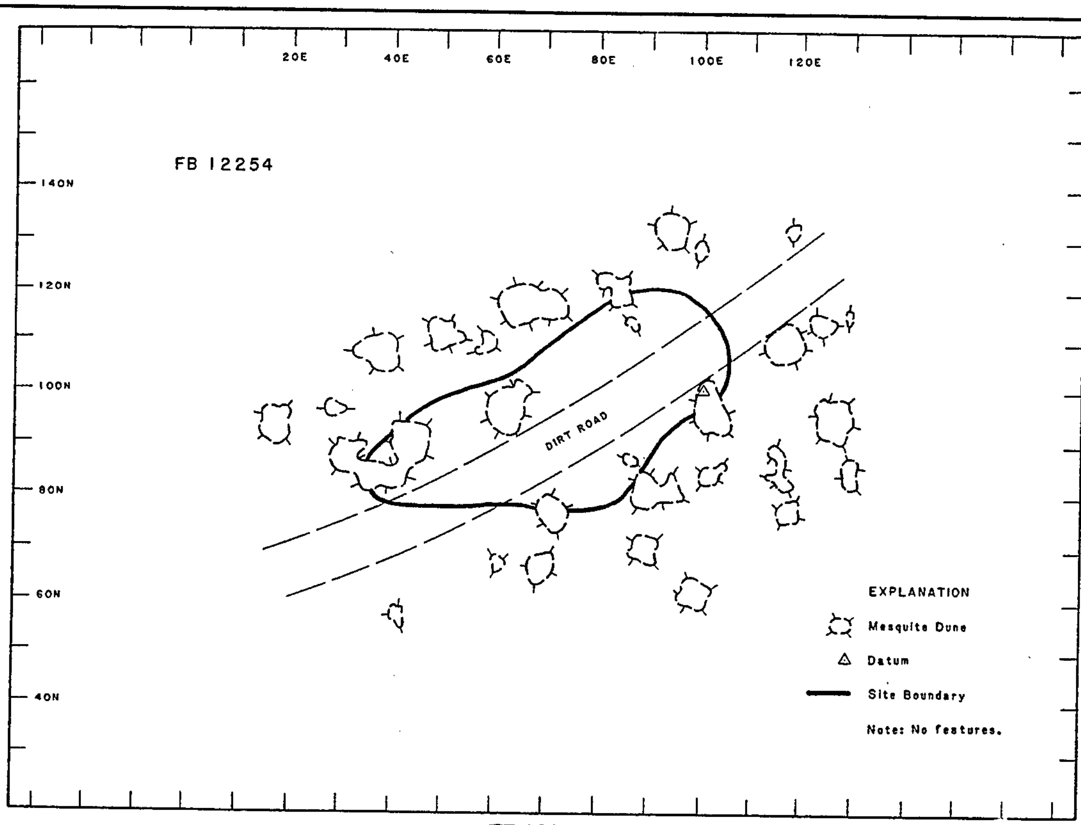
Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Projectile point	2000 B.C.–A.D. 250	Late Archaic



FB12253. *Top,* feature; *bottom,* excavation area.



FB12254.

Size (meters): 1,766

Erosion: Severe

Modern Disturbance: Severe

Surface Features: 0
Total Features: 0
Feature Types: None

Surface Artifacts: 21
Tested Features: 0

Square Meters Tested: 0

Subsurface Artifacts: 0

All surface artifacts were collected during Phase II of the project. No testing of the site was conducted. The site was determined to have no remaining research potential because of the severe deflation and modern disturbance of over 90 percent of the site area and lack of a surface feature. The site area was in a dirt road.

The site was visited during Phase III to verify the lack of additional cultural evidence and to reassess the potential for subsurface material. Reexamination of the site area uncovered one additional surface artifact on the road edge, though as previously assessed the majority of the site was severely deflated and disturbed by modern army activity. This reassessment verified surface collections of artifacts exhausted the research potential of FB12254.

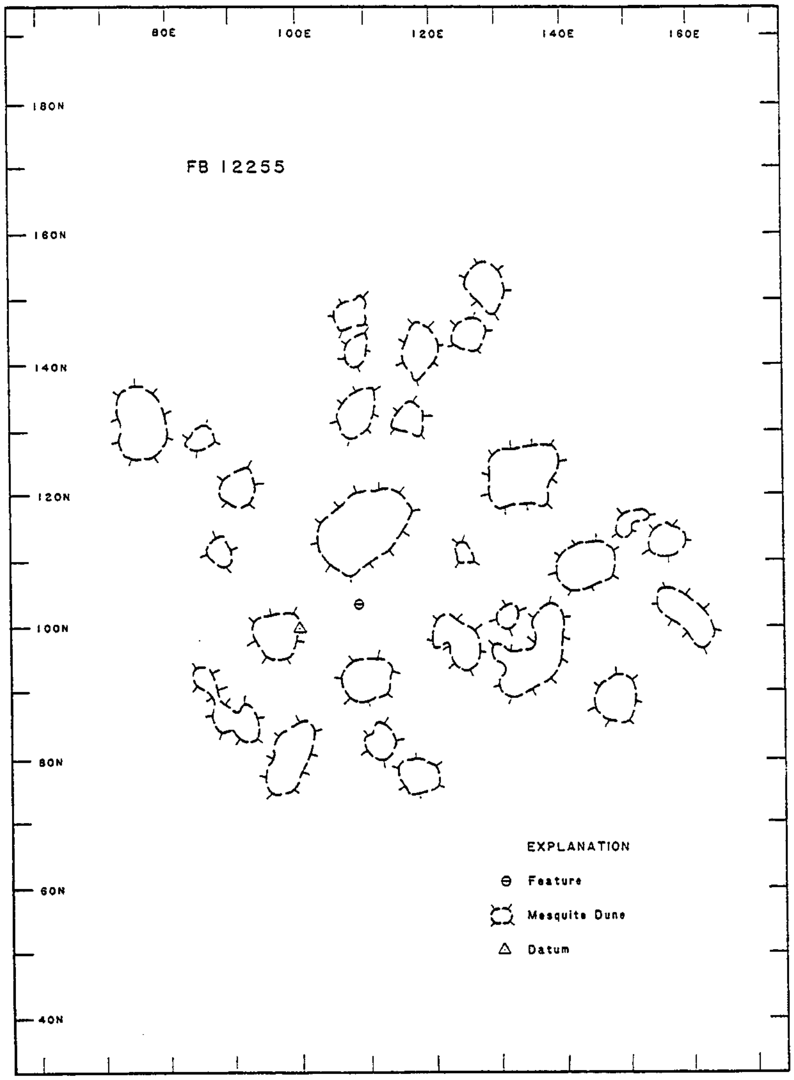
FB12255

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 13



FB12255.

Erosion: Severe

Modern Disturbance: None

Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	0
Feature Types:			
Burned caliche		1	

Square Meters Tested: 0

Subsurface Artifacts: 0

FB12255 was initially recommended for data recovery during Phase II of the project, though the state's assessment was that the site should be considered mitigated. The site was visited during Phase III to determine if additional surface cultural evidence might be present.

Phase III reassessment revealed no additional surface cultural evidence and the deflation of the surface of this site was determined to be the same. Therefore, no testing was conducted and the site should be considered mitigated.

Feature No.	East	North	Type	Tested	Condition
1	109	104	Burned caliche	No	5

FB12256

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 309

Erosion: Low		Modern Disturbance: Low	
Surface Features:	1	Surface Artifacts:	1
Total Features:	1	Tested Features:	1
Feature Types:			

Burned caliche	1

Square Meters Tested: 54 Subsurface Artifacts: 0

Two block excavations, a 1-by-1-square-meter unit, and a backhoe trench were placed on this site. The largest of the block excavations consisted of a 49-square-meter area in the west portion of the site centered over Feature 1. Four square meters were excavated at the east edge of the site where a single surface lithic core was found. The 1-by-1-meter unit was placed against the north edge of the site in the south leading edge of a mesquite dune. The backhoe trench was placed against the west edge of the site.

Excavations did not uncover any subsurface artifacts and the largest block exhausted the subsurface extent of cultural material. No additional features and no concentrations of cultural materials were uncovered. The surface collections and the excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	192	207	Burned caliche with stain	Yes	6

FB12316

Status: 3 (no significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
47944	9	2410 ± 70	790–380 B.C.	Late Archaic

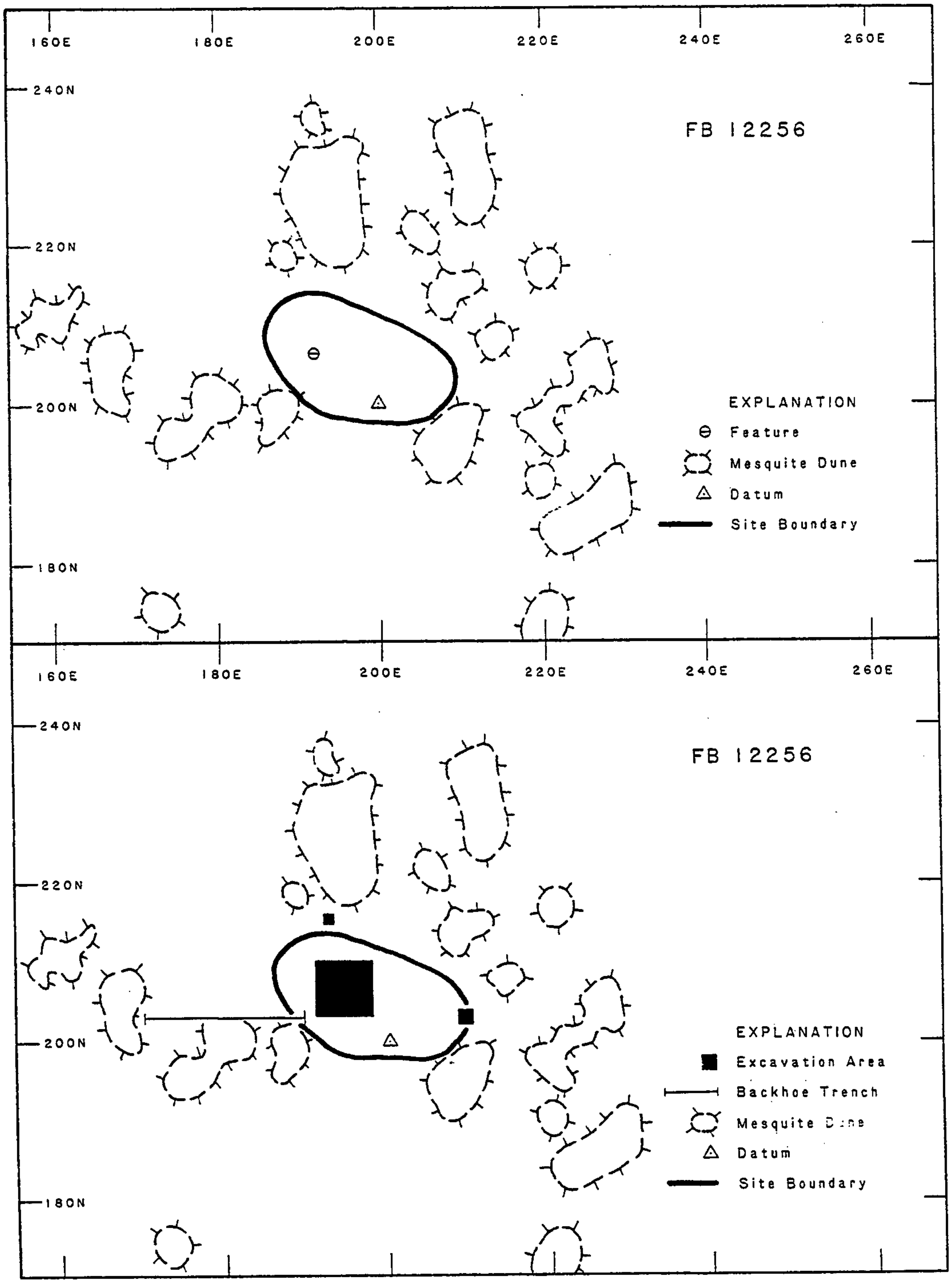
Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-417	234	212	0	3.98	Mesilla phase
DL-92-418	244	217	0	4.77	Mesilla phase/Late Archaic
				3.51	Mesilla phase

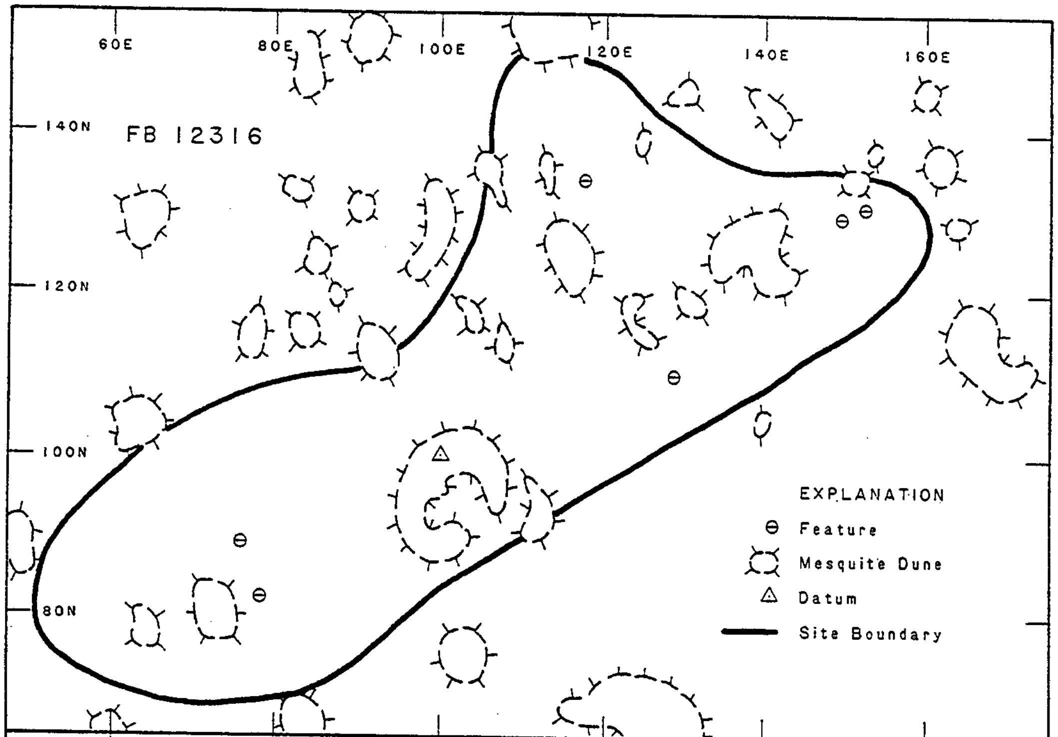
Diagnostic Artifacts: None

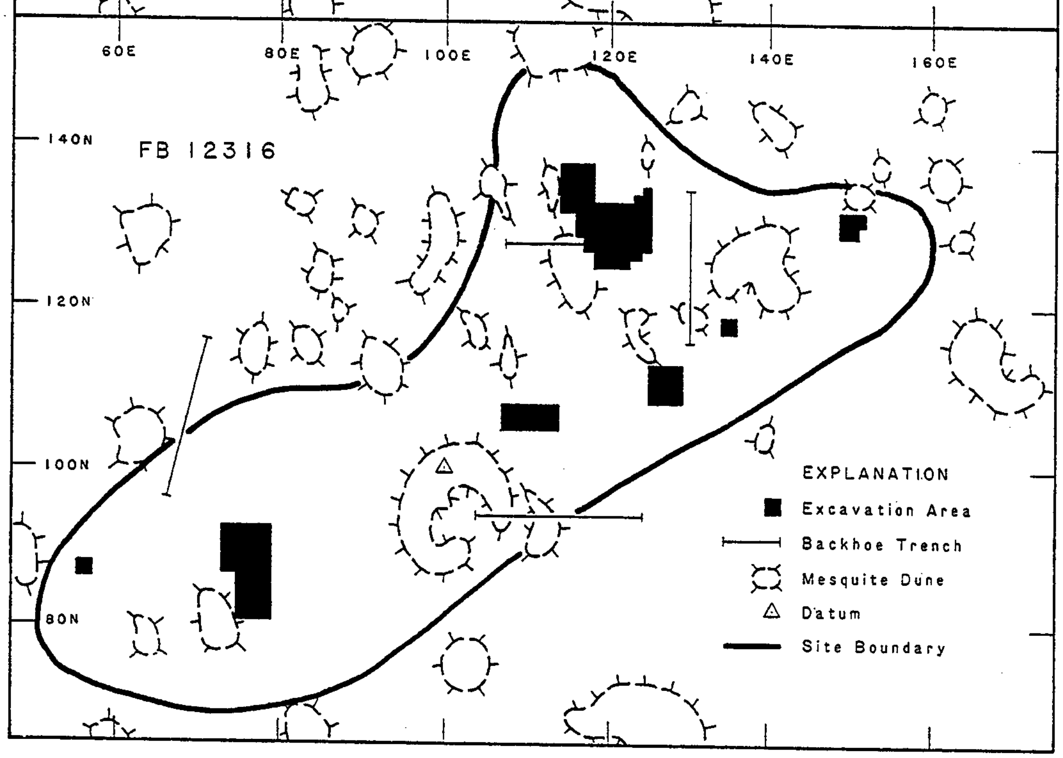
Size (meters): 3,696

Erosion:	Moderate	Modern Disturbance:	Moderate
Surface Features:	6	Surface Artifacts:	34
Total Features:	9	Tested Features:	9



FB12256. *Top,* feature; *bottom,* excavation area.





FB12316. *Top,* feature; *bottom,* excavation area.

Feature Types:

Fire-cracked rock	1
Burned caliche/fire-cracked rock	1
Small stain	8

Square Meters Tested: 207 Subsurface Artifacts: 67
Backhoe Trenches: 4 = 51 square meters

Eight block excavations and four backhoe trenches were established on this site. The largest block excavation consisted of a 64-square-meter area in the north-central portion of the site where a few lithic artifacts were collected from the surface. A 62-square-meter block excavation area was placed in the southwest portion of the site over Features 1 and 7. Twenty-four square meters were excavated adjacent to and northwest of the largest block excavation area over Feature 2. Twenty square meters were placed in the south portion of the site over Feature 5. A 21-square-meter block was excavated in the central portion of the site in an area where a few surface artifacts were collected and some scattered burned caliche pieces were present. An 8-square-meter block was placed at the east edge of the site over Feature 3 and 4. A 4-square-meter block was excavated at the west edge of the site where a few artifacts were collected off the surface. Another 4-square-meter block was dug between the Feature 5 area and Features 3 and 4 in an area of high built-up interdunal sands. The backhoe trenches were placed in the northwest, south-central, north, and northeast portions of the site.

Additional subsurface features were uncovered in association with the Features 1 and 7 block, the 21-square-meter block, and the largest block. These excavation areas were initially smaller, though expanded because of the presence of these subsurface features and also, in the latter case, because of the recovery of lithic artifacts. The excavation of these areas and other areas of the site exhausted the potential of subsurface cultural evidence. Backhoe trenches revealed no additional material. These surface collection and excavation efforts exhausted the research potential of FB12316.

Feature No.	East	North	Type	Tested	Condition
1	179	180	Burned caliche/fire-cracked rock	Yes	4
2	215	233	Burned caliche/fire-cracked rock	Yes	3
3	249	229	Small stain <1 meter	Yes	4
4	250	229	Small stain <1 meter	Yes	7
5	225	210	Small stain <1 meter	Yes	3
7	176	189	Small stain <1 meter	Yes	6

FB12317

Status: [None provided]

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1

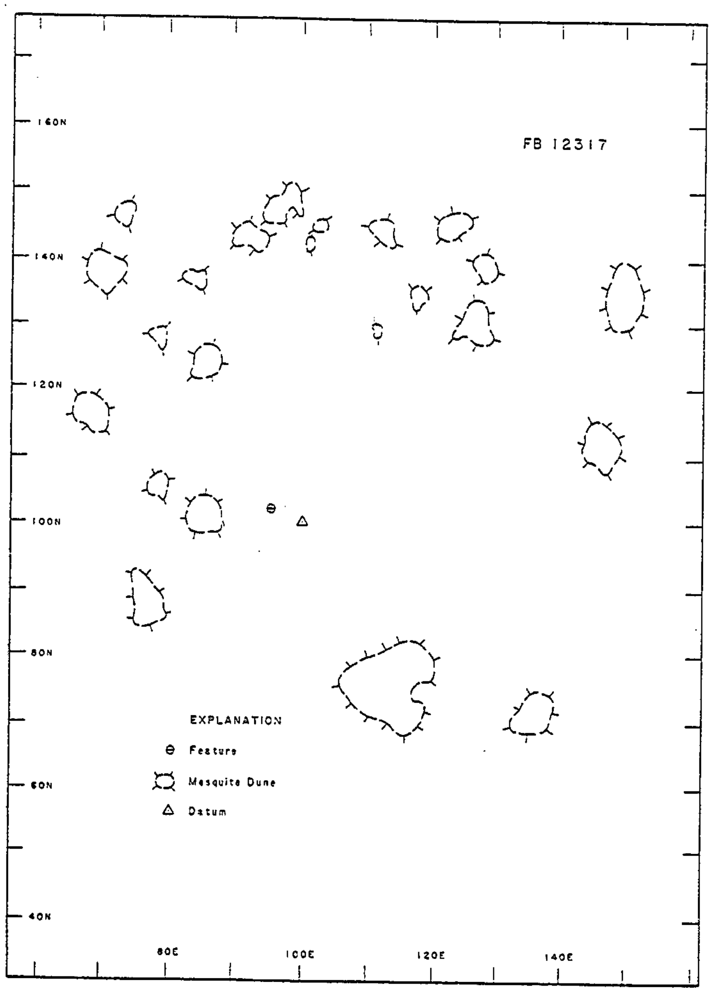
Erosion: Low Modern Disturbance: Severe

Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	0

Feature Types:

Small stain	1

Square Meters Tested: 0 Subsurface Artifacts: 0



FB12317.

This site was initially classified as a site given the presence of a small ash stain. The site was returned to during Phase II and Phase III and the stain was determined to be of modern origin. No prehistoric cultural materials were present. This site has no research potential.

Feature No.	East	North	Type	Tested	Condition
1	95	102	Small stain <1 meter	No	4

FB12318

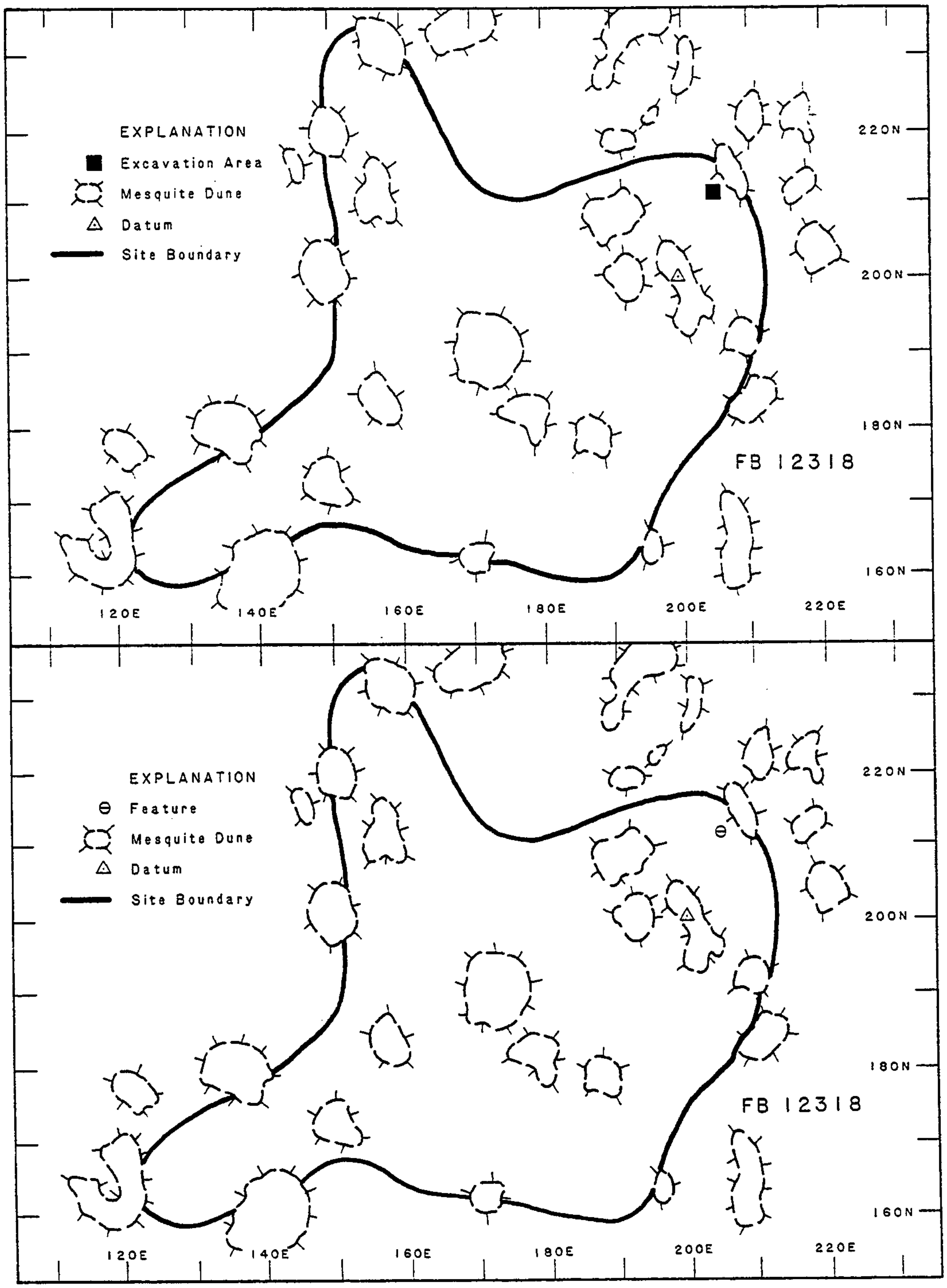
Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 3,715

Erosion: Severe Modern Disturbance: Moderate



FB12318. *Top,* excavation area; *bottom,* feature.

Surface Features:	1	Surface Artifacts:	13
Total Features:	1	Tested Features:	1
Feature Types:			
Small stain		1	

Square Meters Tested: 4   Subsurface Artifacts: 0

The surface artifacts were collected during Phase II of the project. The single identified surface feature was excavated in a 4-square-meter block in the northeast portion of the site. Given the severity of deflation throughout the site, no subsurface features, and no subsurface material, the site was considered mitigated after Phase II.

During Phase III of the project the site was revisited to verify the lack of additional surface evidence and confirm the deflation estimate. The reexamination found one additional surface artifact. The site has no remaining research potential.

Feature No.	East	North	Type	Tested	Condition
1	203	213	Small stain <1 meter	Yes	5

FB12319

Status: 3 (no significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
50110	2	1850 ± 60	A.D. 26–330	Late Archaic/Mesilla phase

Diagnostic Artifacts: None

Size (meters): 950

Erosion: Low   Modern Disturbance: Moderate

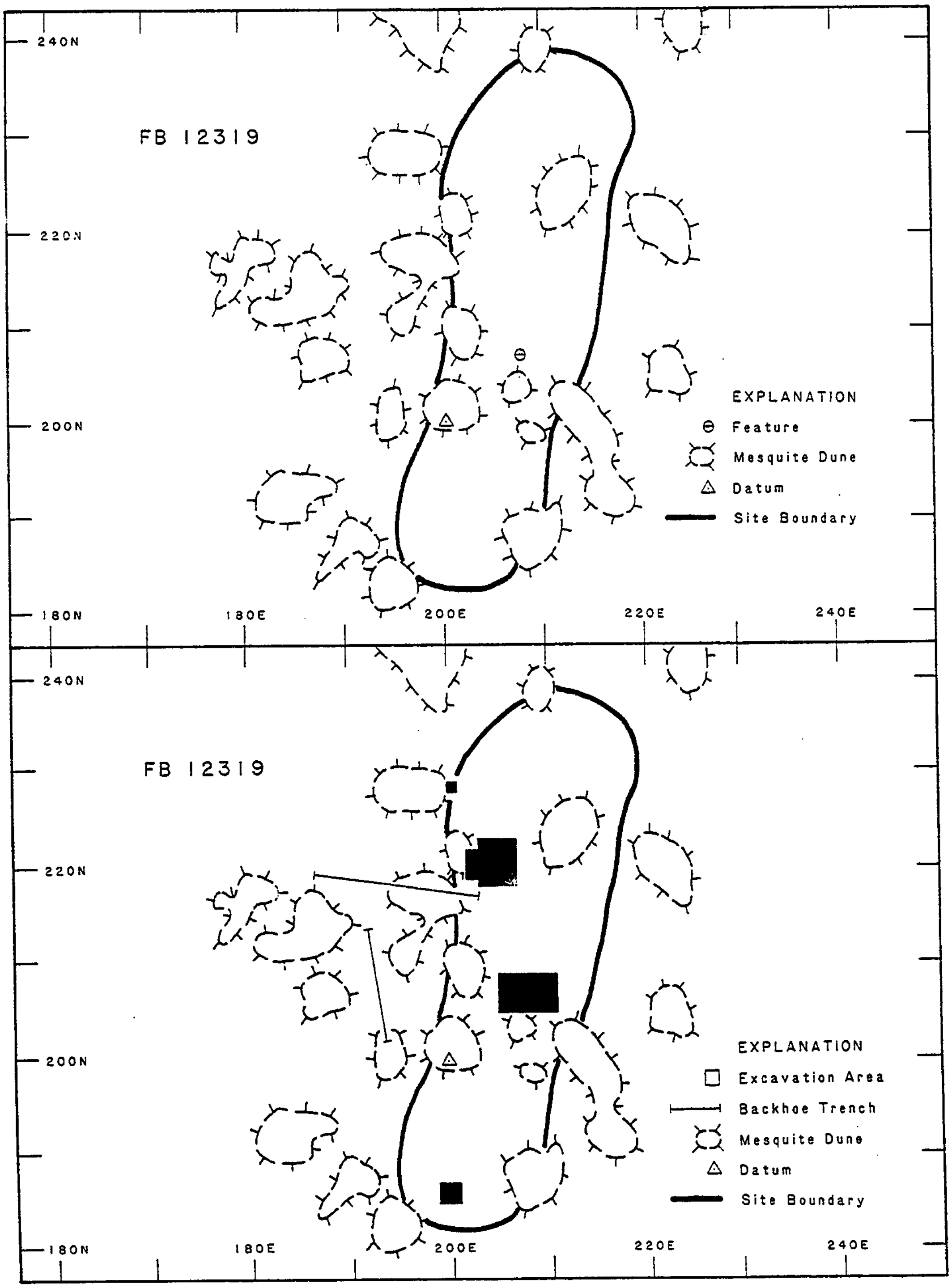
Surface Features:	1	Surface Artifacts:	3
Total Features:	2	Tested Features:	2
Feature Types:			
Small stain		2	

Square Meters Tested: 52   Subsurface Artifacts: 0
Backhoe Trenches: 2 = 20 square meters

Three block excavations, a single 1-by-1-square-meter unit, and two backhoe trenches were established on this site. The largest block consisted of a 24-square-meter area in the central portion of the site over Feature 1. A 23-square-meter block was excavated in the north-central portion of the site in an area where a single ground stone fire-cracked rock piece was collected from the surface. Four square meters were placed in the south portion of the site where a single lithic artifact was collected off the surface. The 1-by-1-meter unit was placed at the northwest corner of the site on the east leading edge of a mesquite dune. The two backhoe trenches were placed at the west edge of the site.

Discovery of a single ash stain feature in the 23-square-meter block resulted in the expansion of an original 4-square-meter block. The remaining excavated areas revealed no subsurface cultural evidence. The surface collections and the excavations conducted exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	208	207	Small stain <1 meter	Yes	5



FB12319. *Top,* feature; *bottom,* excavation area.

FB12320

Status: 1 (significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative period

Size (meters): 4,462

Erosion: Severe — Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	17
Total Features:	1	Tested Features:	1

Feature Types:

Burned caliche/fire-cracked rock	1

Square Meters Tested: 9 — Subsurface Artifacts: 4

The site was tested by a single block excavation over Feature 1 in the southeast portion of the site. The block excavation area consisted of a 9-square-meter area and contained subsurface cultural materials, but did not exhaust the subsurface horizontal extent of these materials.

The site still contains significant data and large areas remain untested.

Feature No.	East	North	Type	Tested	Condition
1	209	170	Burned caliche/fire-cracked rock	Yes	5

FB12321

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1,383

Erosion: Severe — Modern Disturbance: Severe

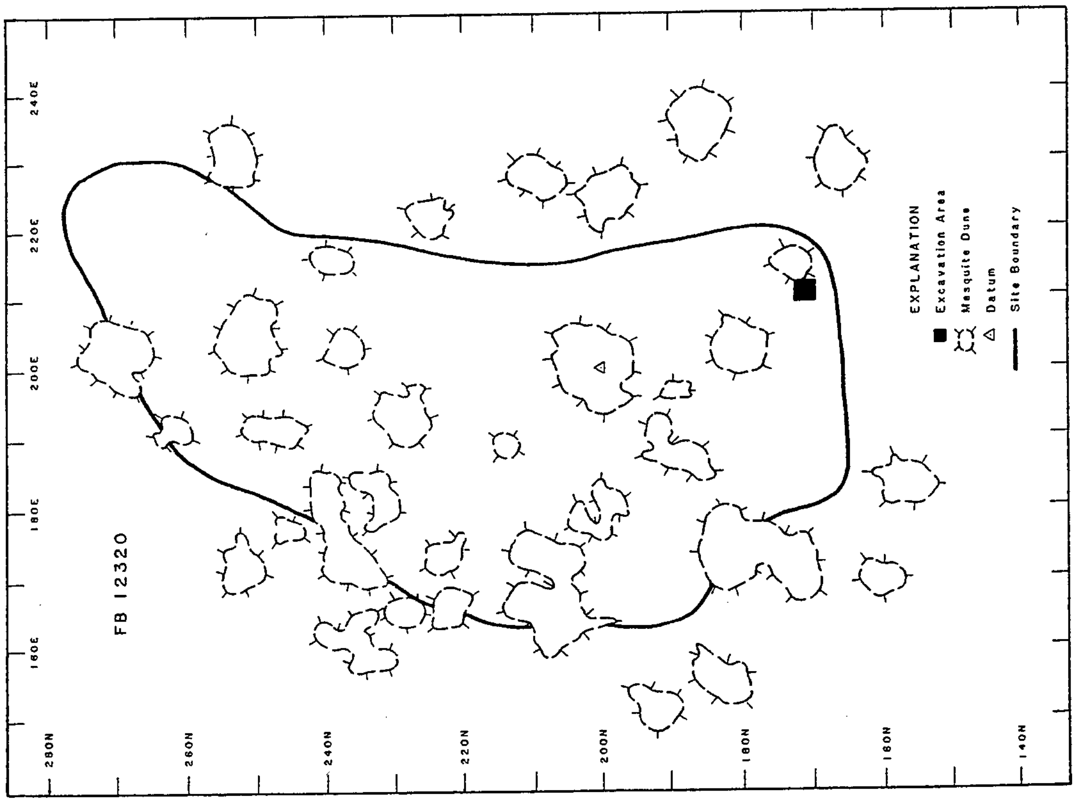
Surface Features:	4	Surface Artifacts:	1
Total Features:	4	Tested Features:	2

Feature Types:

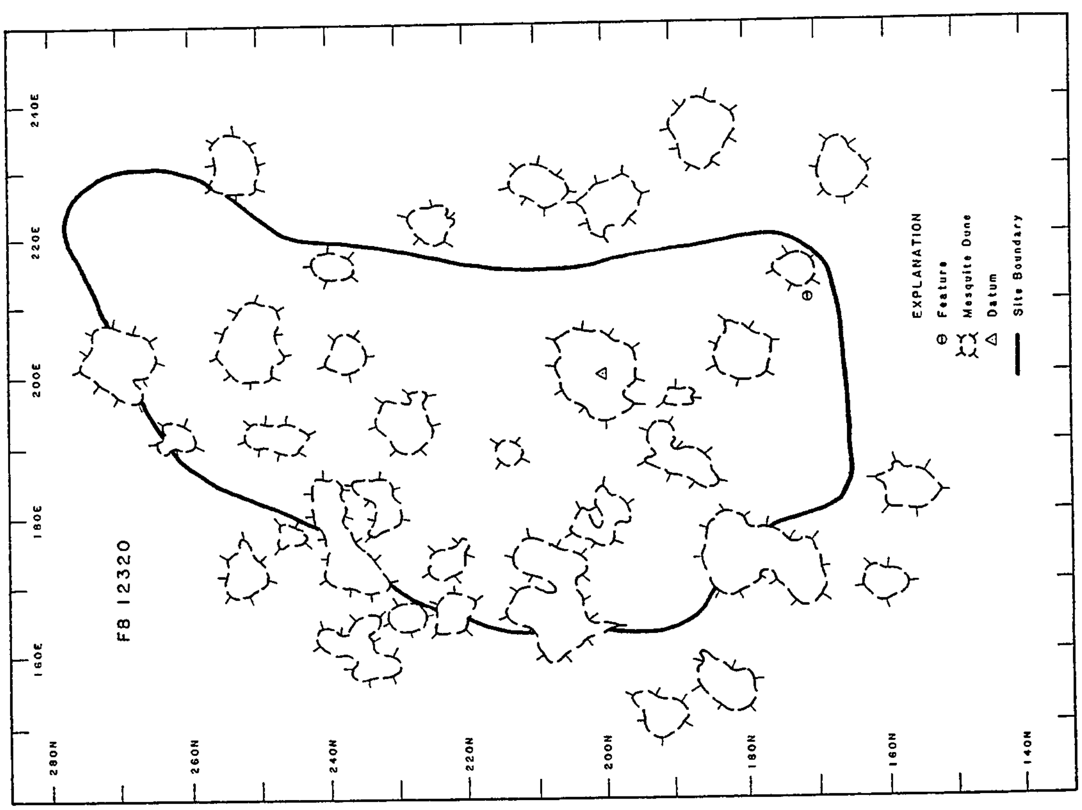
Small stain	4

Square Meters Tested: 53 — Subsurface Artifacts: 0

Three block excavations and a single 1-by-1-square-meter unit were established on this site. A 24-square-meter block was placed in the northeast portion of the site over Feature 1. A similar 24-square-meter block was placed adjacent to the northwest edge of the Feature 1 block over Feature 2. Four square meters were placed in the south portion of the site where a lithic artifact was found on the surface. The 1-by-1-meter unit was placed at the east edge of the site on the west leading edge of a dune. No excavation areas were established in the northwest portion of the site where Features 3 and 4 were noted. These small ash stains observed during Phase II were no longer present. These stains were probably modern in origin as Features 1 and 2 were revealed



FB12320, Excavation Areas.



FB12320, Features.

to be.

No subsurface features or cultural materials were uncovered in the excavations. The surface collections and the excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	175	225	Small stain <1 meter	Yes	4
2	154	226	Small stain <1 meter	No	3
3	155	230	Small stain <1 meter	No	3
4	175	233	Small stain <1 meter	Yes	4

FB12324

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 1450–1950	Protohistoric to Historic

Size (meters): 560

Erosion: Moderate

Modern Disturbance: Severe

Surface Features: 2

Total Features: 2

Surface Artifacts: 29

Tested Features: 2

Feature Types:

Small stain 2

Square Meters Tested: 14

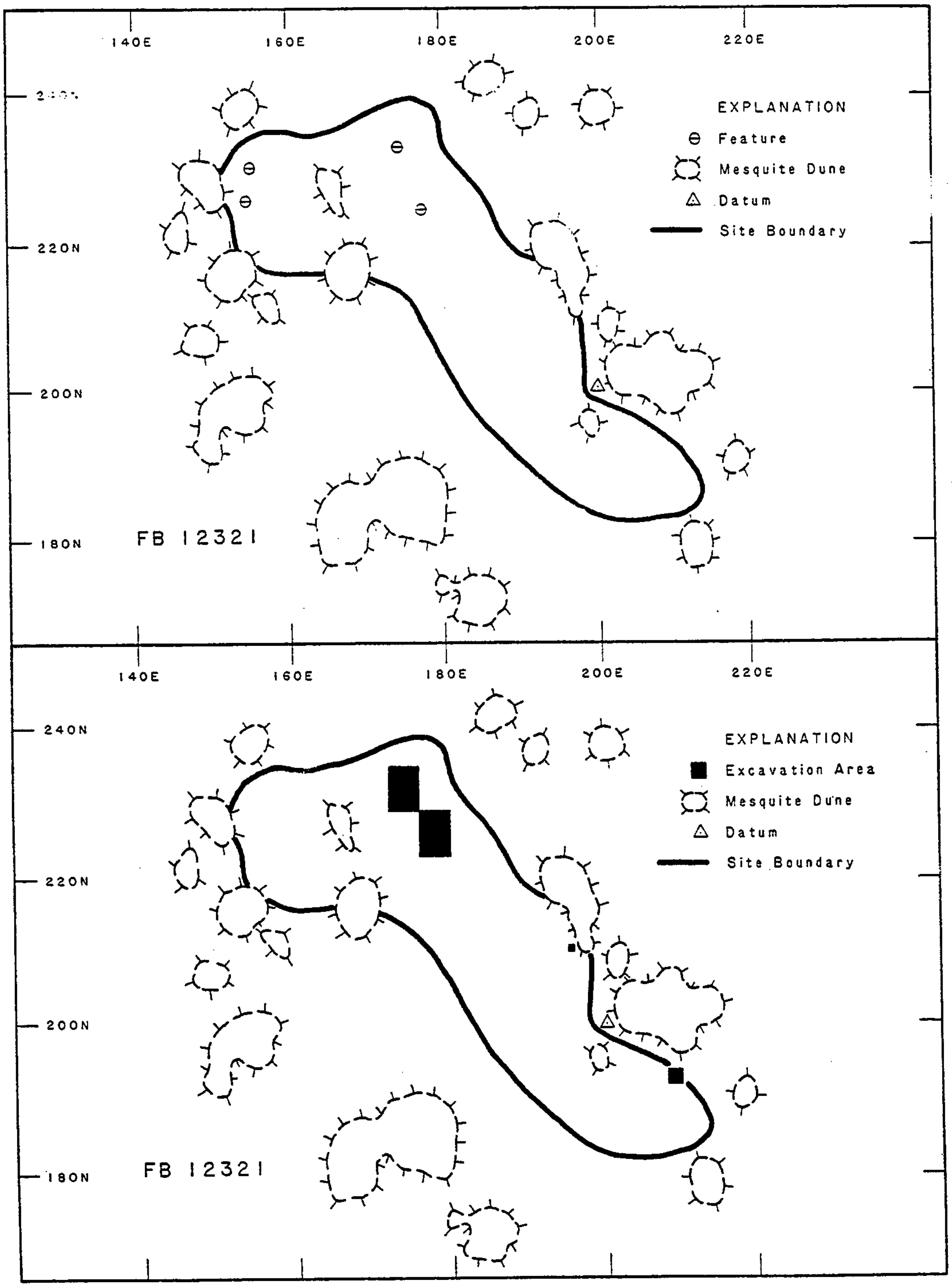
Subsurface Artifacts: 6

Backhoe Trenches: 1 = 15 square meters

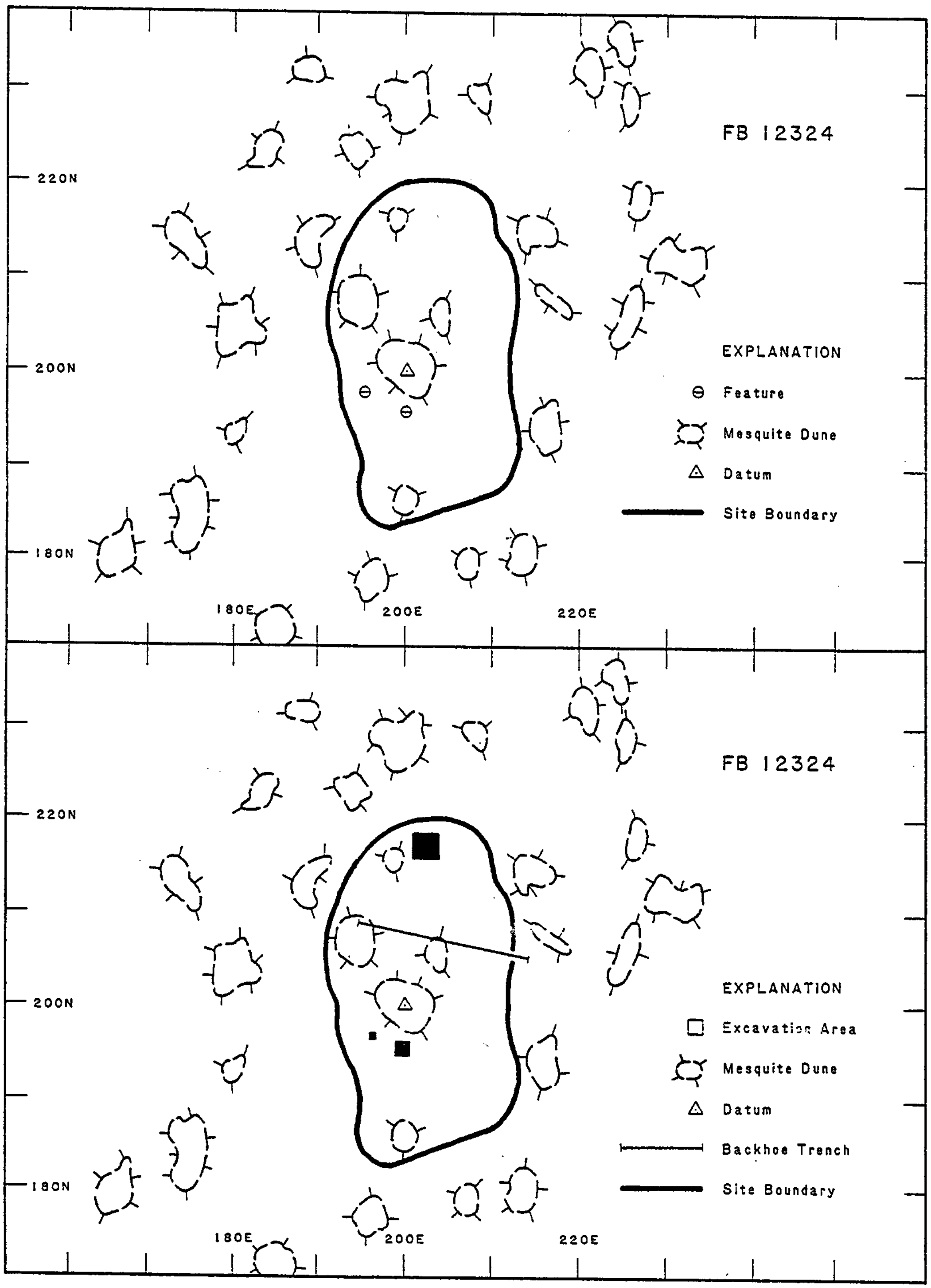
Two block excavations, a 1-by-1-square-meter unit, and a backhoe trench were established on this site. The largest block was a 9-square-meter area in the north portion of the site where all surface ceramics were collected. A 4-square-meter block was excavated over Feature 1. The 1-by-1-meter unit was excavated over Feature 2. These later excavations were in the central portion of the site and were not expanded as the ash stains were determined to be modern. The modern stains were similar to others in the immediate area. The backhoe trench was placed in the north-central portion of the site.

No subsurface features and no subsurface concentrations of cultural materials were found in excavations on this site. The surface collections of cultural materials and the excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	195	197	Small stain <1 meter	Yes	5
2	200	195	Small stain <1 meter	Yes	6



FB12321. *Top,* feature; *bottom,* excavation area.



FB12324. *Top,* feature; *bottom,* excavation area.

FB12326

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 1

Erosion: Severe — Modern Disturbance: Moderate

Surface Features:	1	Surface Artifacts:	0
Total Features:	1	Tested Features:	1

Feature Types:

Small stain	1

Square Meters Tested: 4 — Subsurface Artifacts: 0

The surface of the site contained an ash stain feature. A single 4-square-meter block excavation was placed over the feature. The excavation during Phase II of the project exhausted the research potential of this site as the stain was modern. No prehistoric cultural evidence was present. An examination of the site and the remaining portions of the feature took place during Phase III. No additional cultural evidence was noted.

Feature No.	East	North	Type	Tested	Condition
1	199	205	Small stain <1 meter	Yes	5

FB12327

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts: None

Size (meters): 2,130

Erosion: Low — Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	8
Total Features:	1	Tested Features:	1

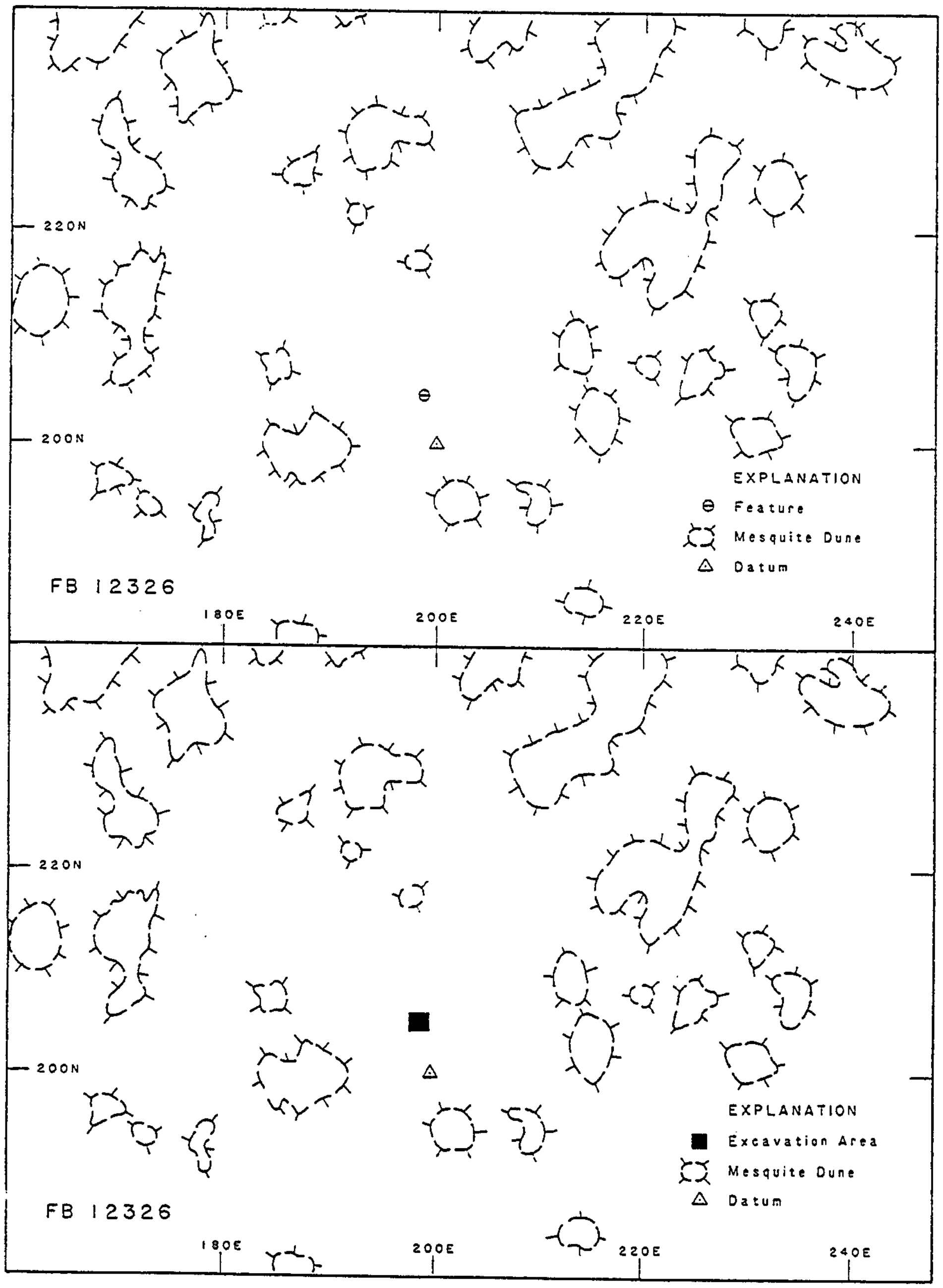
Feature Types:

Small stain	1

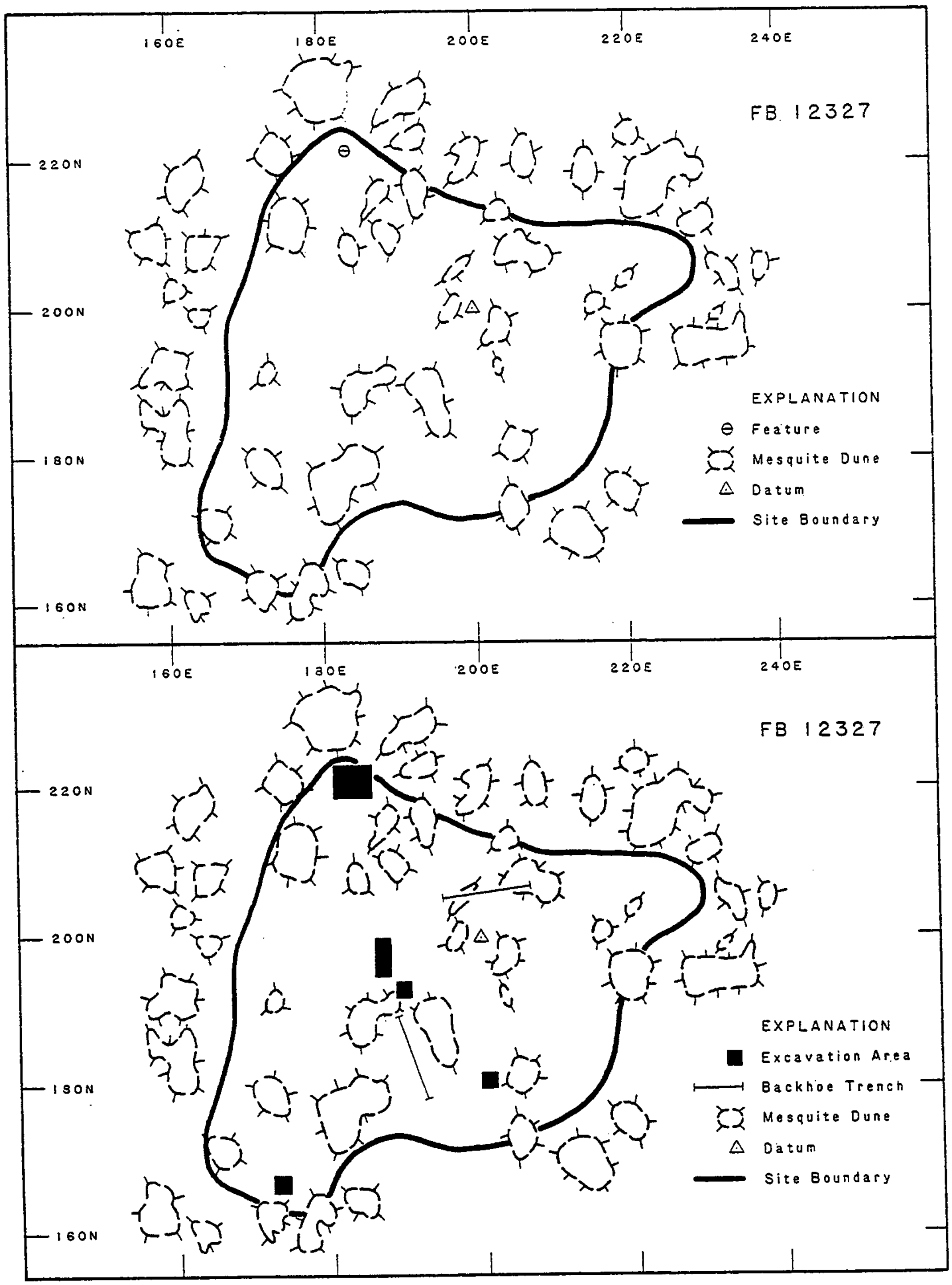
Square Meters Tested: 42 — Subsurface Artifacts: 3

Backhoe Trenches: 2 = 18 square meters

Five block excavations and two backhoe trenches were placed on this site. The largest block was a 20-square-meter area in the northwest portion of the site over Feature 1. A 10-square-meter block was excavated in the central portion of the site to test an area where a few lithic artifacts were collected on the surface. A 4-square-meter area was established in the central portion of the site to test the north leading edge of a mesquite dune where a single piece of burned caliche was present on the surface. Another 4-square-meter block was excavated in the southeast portion of the site to test in an area where a core was collected. The last 4-square-meter block excavation area was in the southwest portion of the site to test an area in which a single lithic flake was found on the surface. The two backhoe trenches were placed in the north-central and the south-central portion of the sites.



FB12326. *Top,* feature; *bottom,* excavation area.



FB12327. *Top,* feature; *bottom,* excavation area.

No subsurface features or concentrations of cultural materials were found in the excavations. The surface collections and the excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	183	222	Small stain <1 meter	Yes	6

FB12329

Status: 3 (no significant data remaining)

Radiocarbon Dates: None

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
Undifferentiated brownware	A.D. 250–1450	Formative

Size (meters): 1,083

Erosion: Severe | Modern Disturbance: Moderate

Surface Features:	2	Surface Artifacts:	4
Total Features:	2	Tested Features:	1

Feature Types:

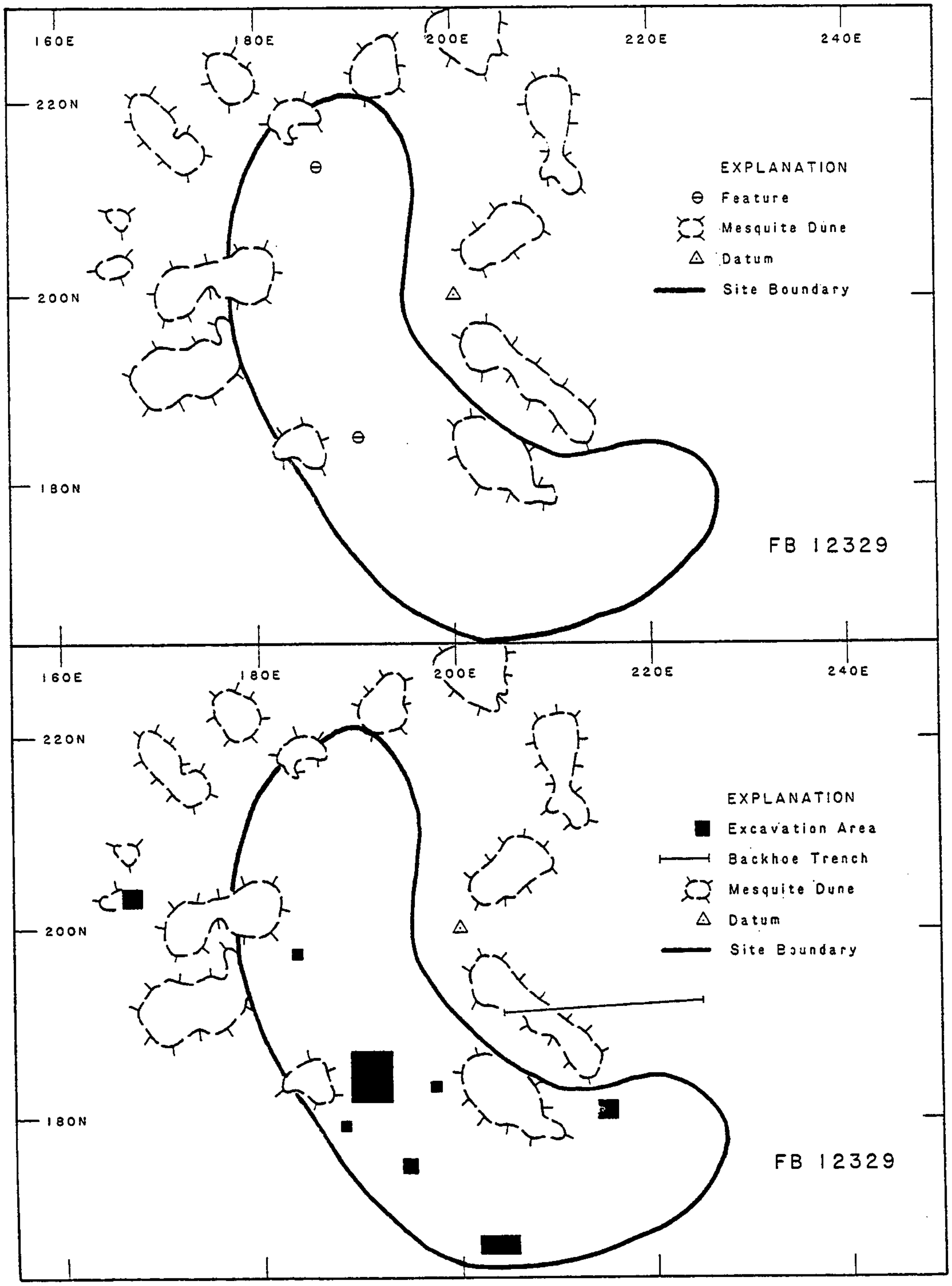
Burned caliche	1
Small stain	1

Square Meters Tested: 38 | Subsurface Artifacts: 2
Backhoe Trenches: 1 = 15 square meters

Four block excavation areas, two 1-by-1-meter units, and a single backhoe trench were excavated on this site. The largest block, located in the south-central portion of the site over Feature 2, was 20 square meters. An 8-meter block was excavated against the south edge of the site to test for subsurface material in an area where a few ceramics were collected. A 4-meter block was excavated in the south-central portion of the site to test for subsurface material in an area where a few pieces of burned caliche were found. Another 4-meter excavation was established at the east portion of the site to test for subsurface material in an area where a single lithic flake was collected. The two 1-by-1-meter units were placed just to the east and the southwest of the Feature 2 block excavation area to test for subsurface material in built-up sands. The single backhoe trench was cut through a large dune field on the east edge of the site. No excavation area was established in association with Feature 1 on the northern edge of the site as the ash stain feature, observed during Phase II, was no longer present. Feature 1 was probably modern.

No subsurface cultural features or artifact concentrations were uncovered. Work on this site has exhausted the research potential.

Feature No.	East	North	Type	Tested	Condition
1	186	213	Small stain <1 meter	No	4
2	189	186	Burned caliche	Yes	4



FB12329. *Top,* feature; *bottom,* excavation area.

FB12330

Status: 3 (no significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
43212	3	1440 ± 50	A.D. 434–647	Mesilla phase
50113	3	1520 ± 60		
47945	7	1140 ± 70	A.D. 777–991	Mesilla phase
47946	7	1290 ± 70		
53368	7	1050 ± 50		
50111	1	1400 ± 50	A.D. 540–757	Mesilla phase
50112	2	2020 ± 60	200 B.C.–A.D. 80	Late Archaic
50114	6	2010 ± 60	197 B.C.–A.D. 126	Late Archaic

Obsidian Hydration Rim Measurements and Dates:

Lab #	East	North	Level	Rim Width	Time Period
DL-92-178	325	329	1	2.45	El Paso phase/Mesilla phase
DL-92-419	325	330	1	2.93	Mesilla phase/El Paso phase

Diagnostic Artifacts:

Artifact Type	Probable Date	Time Period
El Paso Brown rim	A.D. 250–1150	Mesilla phase

Size (meters): 4,647

Erosion: Low — Modern Disturbance: Moderate

Surface Features:	5	Surface Artifacts:	54
Total Features:	13	Tested Features:	13

Feature Types

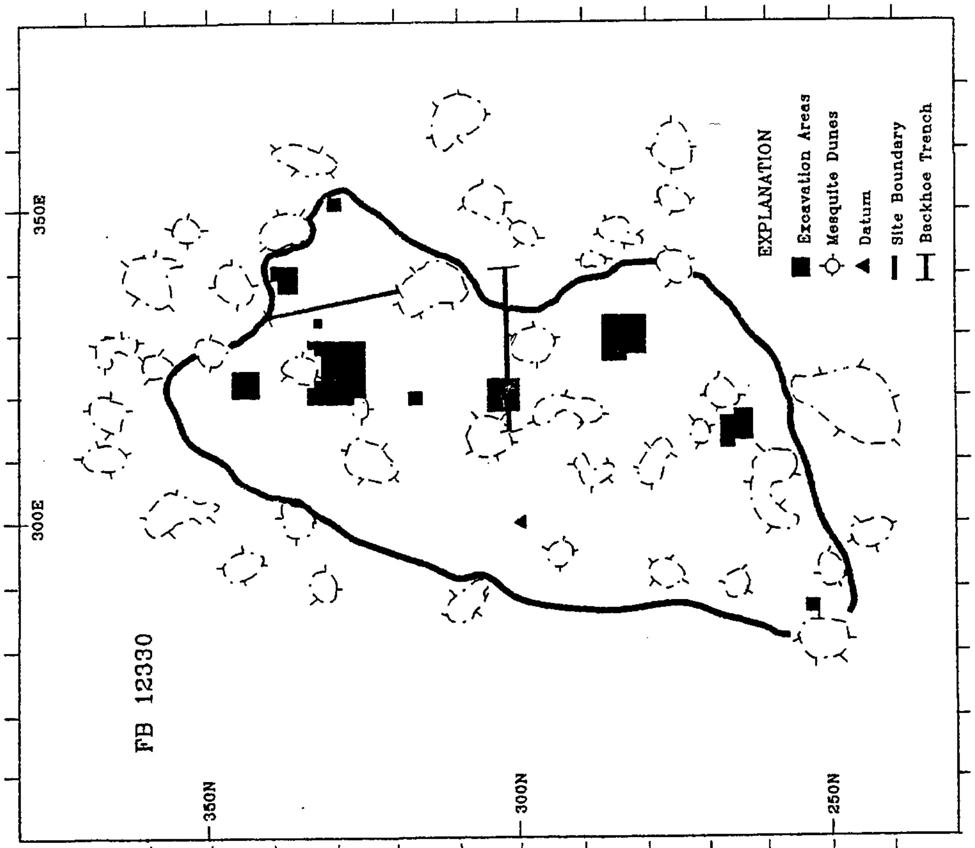
Burned caliche	2
Small stain	10
Large stain	1

Square Meters Tested: 204 — Subsurface Artifacts: 237

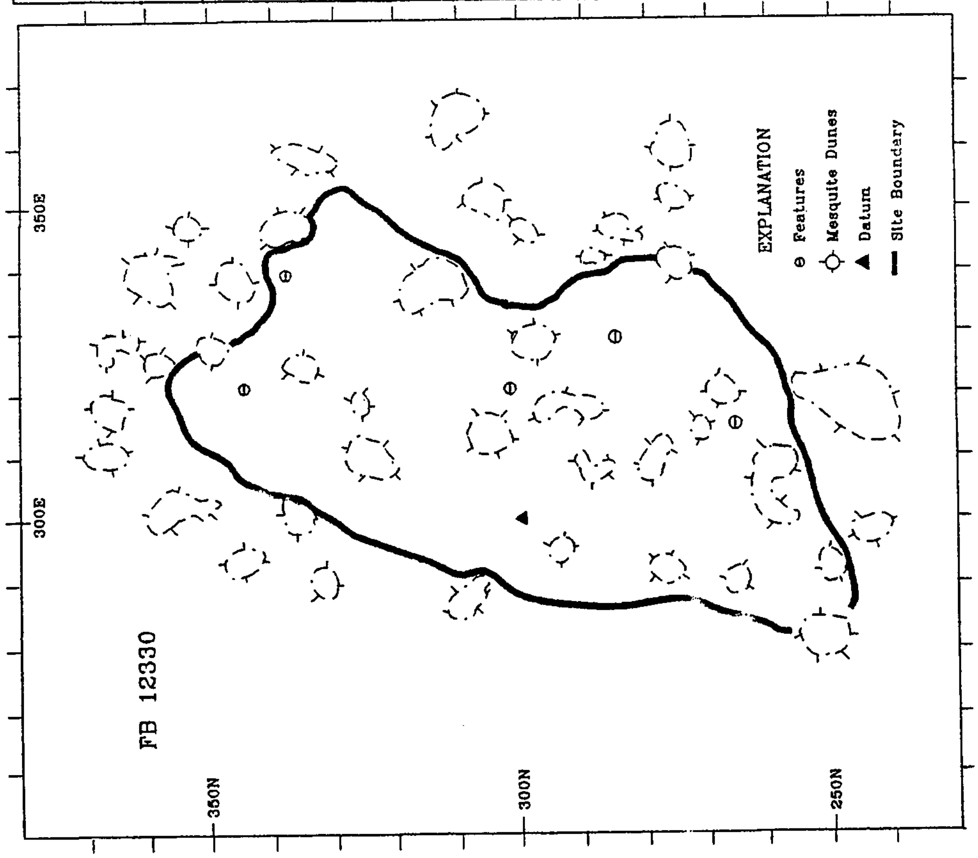
Historic Artifacts: 2 (metal cans A.D. 1900–1930)

Backhoe Trenches: 2 = 30 square meters

Nine block excavations, one 1-by-1-meter unit, and two backhoe trenches were excavated on this site. The largest of the block excavations was 78 square meters. This was placed in the north-central portion of the site to test for subsurface evidence in an area where a few pieces of burned caliche, ground stone fire-cracked rock, and undifferentiated brownware body ceramics were present on the surface. A 46-meter area was located in the southeast portion of the site to investigate Features 1 and 3. A 25-square-meter area was excavated in the central portion of the site to test Feature 4. A 19-square-meter block was excavated in the south-central portion of the site to investigate Feature 2. A 14-square-meter block was excavated in the northeast portion of the site over Feature 9. A 9-square-meter block was excavated in the northwest over Feature 10. A block of 4 square meters was placed in the extreme southwest corner of the site to test for evidence in an area where a lithic core was found. Another 4-square-meter block was placed in the central portion of the site between Feature 4 and the largest excavation area. A 4-square-meter block, excavated against the extreme northeast corner of the site, tested for subsurface material in an area where a core had been found. The single 1-by-1-meter unit was



FB12330, Excavation Areas.



FB12330, Features.

excavated just to the east of the 78-square-meter block in high sands. The two backhoe trenches were cut in the northeast and the east-central portions of the site.

These excavations uncovered eight prehistoric features. The largest block excavation revealed a Mesilla phase pit structure, two possible postholes, a floor hearth, and another small stain. The Feature 4 excavation area contained another ash stain feature (Feature 6) at the east edge of the block near built-up sands. Backhoe trenches were strategically located through this area to test for additional subsurface cultural evidence. The Feature 1 and 3 excavation area contained an associated small ash stain that was designated Feature 5. The combination of block excavations, surface collection, and backhoe trenching exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	329	285	Burned caliche with stain	Yes	6
2	315	265	Small stain <1 meter	Yes	3
4	321	302	Small stain <1 meter	Yes	5
9	339	337	Small stain <1 meter	Yes	3
10	321	344	Small stain <1 meter	Yes	3

FB12331

Status: 3 (no significant data remaining)

Radiocarbon Dates:

Beta #	Feature #	Date	Corrected Date	Time Period
50115	3	2060 ± 60	349 B.C.–A.D. 60	Late Archaic

Diagnostic Artifacts: None

Size (meters): 188

Erosion: Low | Modern Disturbance: Low

Surface Features:	1	Surface Artifacts:	0
Total Features:	5	Tested Features:	5

Tested Features:

Burned caliche	1
Small stain	4

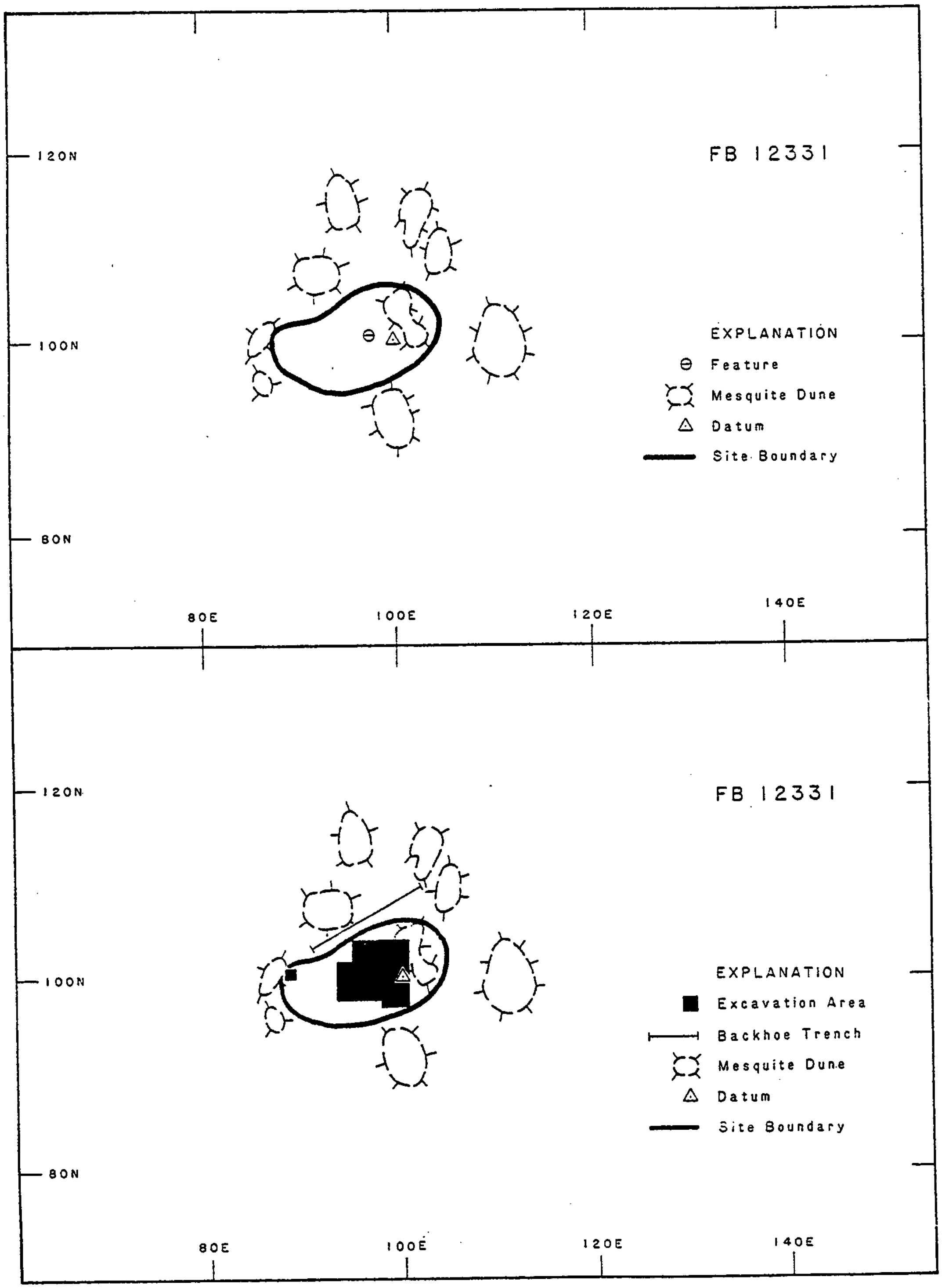
Square Meters Tested: 49 | Subsurface Artifacts: 12

Backhoe Trenches: 1 = 10 square meters

A large block excavation area, a 1-by-1-meter unit, and a backhoe trench were excavated on this site. The block excavation area consisted of 48 square meters located in the central portion of the site over Feature 1. The 1-by-1-meter unit was at the west edge of the site in the edge of a mesquite dune. The backhoe trench was at the north edge of the site.

Four subsurface prehistoric features were uncovered within the large block excavation area. This excavation area was expanded to the 48-square-meter area to mitigate the research potential of subsurface material in association with the five prehistoric features identified and excavated. The excavations exhausted the research potential of this site.

Feature No.	East	North	Type	Tested	Condition
1	98	101	Burned caliche	Yes	3



FB12331. *Top,* feature; *bottom,* excavation area.

Appendix D

Backhoe Trench Descriptions

This appendix provides descriptive information on backhoe trenches dug both on site and off site in and around the project area. Profiles for all trenches are available at the Directorate of Environment, Conservation Division, Fort Bliss, Texas. The location of trenches associated with sites are provided in Appendix C. No archaeological features were discovered in backhoe trenches.

Table D1. Backhoe Trench Data.

Site No.	Trench No.	Length (m)	Depth below datum (m)	Average Thickness (cm) Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
FB10408	1	11	3.38–4.96	56	26	30	8	14+
FB10408	2	19	3.34–5.00	14	–	22	12	34+
FB10409	1	14	4.70–5.80	14	26	10	34+	–
FB10409	2	8	3.98–5.80	12	72	56	16+	–
FB10412	1	11	4.04–5.12	6	–	28	4	26+
FB10413	1	15	3.60–5.20	54	4	72	10+	–
FB10414	1	16	4.50–4.34	64	22	34	28+	–
FB10414	2	19	2.06–3.92	50	54	12	14	12+
FB10416	1	17	2.86–4.52	20	18	54	16	36+
FB12097	1	20	1.76–3.38	46	52	40	38+	–
FB12097	2	10	1.90–3.30	16	22	58	20+	–
FB12097	3	16	0.70–3.30	18	42	20+	–	–
FB12226	1	18	3.74–5.44	10	38	52	40+	–
FB12237	1	30	3.24–4.22	6	23	58	14+	–
FB12256	1	20	2.76–4.26	10	58	26	22	12+
FB12316	1	20	3.30–5.30	50	12	58	34+	–
FB12316	2	10	2.84–5.60	90	20	14	102	10+
FB12316	3	20	3.20–5.48	56	4	48	30+	–
FB12316	4	20	4.00–5.48	22	12	8	72+	–
FB12319	1	11	3.96–5.90	18	14	64	44+	–

Zone 1: Loose consolidated eolian sand, no carbonate filaments.

Zone 2: No eolian strata, no carbonate filaments.

Zone 3: Carbonate filaments with consolidated sand.

Zone 4: Carbonate nodules with consolidated sand.

Zone 5: Carbonate accumulations.

Continued on next page.

Table D1 Continued.

Site No.	Trench No.	Length (m)	Depth below datum (m)	Average Thickness (cm)				
				Zone 1	Zone 2	Zone 3	Zone 4	Zone 5
FB12319	2	16	4.14–5.64	16	22	32	52+	–
FB12324	1	20	3.30–5.02	44	–	22	12	32+
FB12327	1	12	3.58–5.44	46	6	54	56+	–
FB12327	2	13	2.64–4.14	48	28	16+	–	–
FB12329	1	20	3.28–5.32	54	4	68	14	28+
FB12330	1	20	2.78–5.46	44	86	40	–	–
FB12330	2	20	2.82–5.66	82	6	88	56+	–
FB12331	1	14	4.00–4.90	16	–	22	8	16+
Playa	1	20	0.26–1.78	30	14	20	40	30+
Playa	2	20	0.14–1.90	35	34	40	18+	–

Appendix E

ARTIFACTS BY SITE

FB6741 (41EP1028)

	#	%
Undifferentiated brownware sherd	159	7.7
El Paso Brown rim sherd	1	0.0
Worked sherd	1	0.0
Angular lithic debitage	54	2.6
Utilized angular lithic debitage	7	0.3
Bipolar/tested core	3	0.1
Tested pebble/cobble	13	0.6
Flake	1,253	60.0
Utilized flake	151	7.3
Unimarginally retouched lithic	31	1.5
Bimarginally retouched lithic	1	0.0
Unifacially retouched lithic	13	0.6
Bifacially retouched lithic	12	0.6
Projectile point	1	0.0
Core	33	1.6
Angular hammerstone	23	1.1
Rounded hammerstone	25	1.2
Mano	1	0.0
Mano fragment	58	2.8
Metate	2	0.1
Metate fragment	124	6.0
Mano/metate fragment	11	0.5
Other ground stone	97	4.0
Total	2,074	99.0

FB7483 (41EP1037)

	#	%
Angular lithic debitage	14	2.6
Utilized angular lithic debitage	4	0.7
Bipolar/tested core	3	0.6
Tested pebble/cobble	8	1.5
Flake	387	71.0
Utilized flake	33	6.1
Unimarginally retouched lithic	9	1.7
Bimarginally retouched lithic	2	0.4
Unifacially retouched lithic	3	0.6
Bifacially retouched lithic	2	0.4
Projectile point	2	0.4
Core	17	3.1
Angular hammerstone	5	0.9
Rounded hammerstone	2	0.4
Mano fragment	27	5.0
Metate fragment	5	0.9
Mano/metate fragment	1	0.2
Other ground stone	16	3.0
Total	540	99.5

FB7484 (41EP1034)

	#	%
Undifferentiated brownware sherd	22	8.3
El Paso Bichrome sherd	5	1.9
Worked sherd	1	0.4
Angular lithic debitage	6	2.3
Utilized angular lithic debitage	2	0.8
Bipolar/tested core	4	1.5
Tested pebble/cobble	4	1.5
Flake	117	44.0
Utilized flake	32	12.0
Unimarginally retouched lithic	3	1.1
Unifacially retouched lithic	2	0.8
Bifacially retouched lithic	1	0.4
Projectile point	3	1.1
Core	19	7.1
Angular hammerstone	3	1.1
Rounded hammerstone	2	0.8
Mano fragment	7	2.6
Metate fragment	18	6.8
Mano/metate fragment	1	0.4
Other ground stone	14	5.3
Total	266	100.2

FB7505 (41EP985)

	#	%
Undifferentiated brownware sherd	5	12.5
Angular lithic debitage	1	2.5
Flake	12	30.0
Utilized flake	5	12.5
Angular hammerstone	1	2.5
Mano fragment	1	2.5
Metate fragment	2	5.0
Mano/metate fragment	1	2.5
Other ground stone	12	30.0
Total	40	100.0

FB7508 (41EP982)

	#	%
Angular lithic debitage	1	1.2
Utilized angular lithic debitage	1	1.2

Tested pebble/cobble	1	1.2
Flake	33	40.7
Utilized flake	9	11.1
Unimarginally retouched lithic	3	3.7
Bimarginally retouched lithic	1	1.2
Unifacially retouched lithic	2	2.5
Core	6	7.4
Angular hammerstone	1	1.2
Rounded hammerstone	3	3.7
Mano	2	2.5
Mano fragment	2	2.5
Metate	1	1.2
Metate fragment	9	11.1
Mano/metate fragment	1	1.2
Other ground stone	5	6.2
Total	81	99.8

FB7510 (41EP978)

	#	%
Undifferentiated brownware sherd	38	5.3
El Paso Bichrome sherd	2	0.3
El Paso Polychrome sherd	2	0.3
Worked sherd	1	0.1
Angular lithic debitage	8	1.1
Utilized angular lithic debitage	4	0.6
Bipolar/tested core	9	1.3
Tested pebble/cobble	8	1.1
Flake	349	48.7
Utilized flake	68	9.5
Unimarginally retouched lithic	30	4.2
Bimarginally retouched lithic	2	0.3
Unifacially retouched lithic	8	1.1
Bifacially retouched lithic	3	0.4
Projectile point	1	0.1
Core	35	4.9
Angular hammerstone	13	1.8
Rounded hammerstone	5	0.7
Mano	4	0.6
Mano fragment	19	2.7
Metate fragment	54	7.5
Mano/metate fragment	4	0.6
Other ground stone	49	6.8
Total	716	100.0

FB7517 (41EP972)

	#	%
Undifferentiated brownware sherd	20	9.7
Angular lithic debitage	3	1.4
Bipolar/tested core	4	1.9
Tested pebble/cobble	1	0.5
Flake	69	33.3
Utilized flake	6	2.9
Bimarginally retouched lithic	1	0.5
Unifacially retouched lithic	2	1.0
Projectile point	1	0.5
Core	8	3.9
Angular hammerstone	9	4.3
Rounded hammerstone	2	1.0
Mano fragment	13	6.3
Metate fragment	32	15.5
Mano/metate fragment	2	1.0
Other ground stone	34	16.4
Total	207	100.1

FB7520 (41EP970)

	#	%
Undifferentiated brownware sherd	56	11.5
Worked sherd	2	0.4
Angular lithic debitage	17	3.5
Utilized angular lithic debitage	3	0.6
Bipolar/tested core	5	1.0
Tested pebble/cobble	4	0.8
Flake	176	36.0
Utilized flake	32	6.6
Unimarginally retouched lithic	8	1.6
Bimarginally retouched lithic	1	0.2
Unifacially retouched lithic	1	0.2
Bifacially retouched lithic	2	0.4
Projectile point	3	0.6
Core	17	3.5
Angular hammerstone	9	1.8
Rounded hammerstone	8	1.6
Mano fragment	32	6.6
Metate fragment	69	14.0
Mano/metate fragment	4	0.8
Other ground stone	38	7.8
Total	487	99.5

FB7547

	#	%
Undifferentiated brownware sherd	41	6.5
El Paso Brown rim sherd	1	0.2
El Paso Bichrome sherd	1	0.2
Mimbres Transitional sherd	1	0.2
Mimbres Transitional rim sherd	1	0.2
Other rim sherd sherd	2	0.3
Worked sherd	1	0.2
Angular lithic debitage	14	2.2
Utilized angular lithic debitage	3	0.5
Bipolar/tested core	3	0.5
Tested pebble/cobble	4	0.6
Flake	243	38.7

Utilized flake	32	5.1
Unimarginally retouched lithic	10	1.6
Bimarginally retouched lithic	1	0.2
Unifacially retouched lithic	5	0.8
Bifacially retouched lithic	3	0.5
Projectile point	2	0.3
Core	15	2.4
Angular hammerstone	11	1.8
Rounded hammerstone	12	1.9
Mano	3	0.5
Mano fragment	40	6.4
Metate	2	0.3
Metate fragment	56	8.9
Mano/metate fragment	4	0.6
Other ground stone	117	18.6
Total	628	100.2

FB7569 (41EP962)

	#	%
Angular lithic debitage	2	3.8
Flake	36	67.9
Utilized flake	7	13.2
Unifacially retouched lithic	1	1.9
Rounded hammerstone	1	1.9
Mano fragment	3	5.7
Metate fragment	2	3.8
Other ground stone	1	1.9
Total	53	100.1

FB7580 (41EP1753)

	#	%
Angular lithic debitage	2	1.1
Tested pebble/cobble	1	0.5
Flake	62	33.3
Utilized flake	10	5.4
Unimarginally retouched lithic	5	2.7
Bifacially retouched lithic	2	1.1
Core	6	3.2
Angular hammerstone	6	3.2
Rounded hammerstone	3	1.6
Mano	1	0.5
Mano fragment	20	10.8
Metate fragment	28	15.1
Mano/metate fragment	1	0.5
Other ground stone	39	21.0
Total	186	100.0

FB7583 (41EP1750)

	#	%
Angular lithic debitage	1	2.9
Bipolar/tested core	2	5.9
Flake	17	50.0
Utilized flake	4	11.8
Unimarginally retouched lithic	2	5.9
Core	4	11.8
Angular hammerstone	1	2.9
Other ground stone	3	8.8
Total	34	100.0

FB10407

	#	%
Flake	5	55.6
Utilized flake	2	22.2
Unimarginally retouched lithic	1	11.1
Angular hammerstone	1	11.1
Total	9	100.0

FB10408

	#	%
Angular lithic debitage	1	25.0
Flake	2	50.0
Metate fragment	1	25.0
Total	4	100.0

FB10409

	#	%
Angular lithic debitage	1	20.0
Utilized flake	1	20.0
Metate fragment	2	40.0
Other ground stone	1	20.0
Total	5	100.0

FB10410

	#	%
Angular lithic debitage	1	2.6
Flake	23	60.5
Utilized flake	3	7.9
Unimarginally retouched lithic	2	5.3
Unifacially retouched lithic	1	2.6
Bifacially retouched lithic	1	2.6
Core	1	2.6
Rounded hammerstone	1	2.6
Mano fragment	3	7.9
Metate fragment	2	5.3
Total	38	99.9

FB10411

	#	%
Undifferentiated brownware sherd	104	32.9
El Paso Bichrome sherd	80	25.3
El Paso Bichrome rim sherd	3	0.9

El Paso Polychrome sherd	16	5.1
El Paso Polychrome rim sherd	2	0.6
Angular lithic debitage	5	1.6
Utilized angular lithic debitage	1	0.3
Flake	74	23.4
Utilized flake	3	0.9
Unimarginally retouched lithic	1	0.3
Projectile point	1	0.3
Core	2	0.6
Angular hammerstone	1	0.3
Mano fragment	4	1.3
Metate fragment	8	2.5
Other ground stone	11	3.5
Total	316	99.8

FB10412

	#	%
Undifferentiated brownware sherd	8	80.0
Angular lithic debitage	1	10.0
Utilized flake	1	10.0
Total	10	100.0

FB10413

	#	%
Angular lithic debitage	2	2.4
Utilized angular lithic debitage	1	1.2
Flake	1	1.2
Bimarginally retouched lithic	1	1.2
Rounded hammerstone	1	1.2
Metate fragment	27	31.8
Other ground stone	52	61.2
Total	85	100.2

FB10414

	#	%
Tested pebble/cobble	1	7.1
Flake	11	78.6
Utilized flake	1	7.1
Mano fragment	1	7.1
Total	14	99.9

FB10415

	#	%
Flake	1	20.0
Unimarginally retouched lithic	1	20.0
Projectile point	1	20.0
Core	2	40.0
Total	5	100.0

FB10416

	#	%
El Paso Brown rim sherd	1	4.8
Flake	9	42.9
Utilized flake	1	4.8
Unifacially retouched lithic	1	4.8
Angular hammerstone	1	4.8
Mano fragment	1	4.8
Metate fragment	6	28.6
Other ground stone	1	4.8
Total	21	100.3

FB10417

	#	%
Undifferentiated brownware sherd	33	25.4
El Paso Brown rim sherd	5	3.8
Angular lithic debitage	2	1.5
Utilized angular lithic debitage	1	0.8
Bipolar/tested core	1	0.8
Flake	55	42.3
Utilized flake	1	0.8
Unimarginally retouched lithic	1	0.8
Core	2	1.5
Angular hammerstone	2	1.5
Rounded hammerstone	1	0.8
Mano fragment	2	1.5
Metate fragment	18	13.8
Other ground stone	6	4.6
Total	130	99.9

FB10418

	#	%
Unimarginally retouched lithic	1	50.0
Other ground stone	1	50.0
Total	2	100.0

FB10419

	#	%
Unimarginally retouched lithic	1	100.0

FB10420

	#	%
Tested pebble/cobble	1	20.0
Flake	3	60.0
Other ground stone	1	20.0
Total	5	100.0

FB11298

	#	%
Flake	25	35.2
Utilized flake	3	4.2
Unimarginally retouched lithic	1	1.4
Bifacially retouched lithic	1	1.4
Core	1	1.4
Metate fragment	24	33.8
Other ground stone	16	22.5
Total	71	99.9

FB11299

	#	%
Undifferentiated brownware sherd	2	5.4
El Paso Brown rim sherd	1	2.7
Worked sherd	3	8.1
Angular lithic debitage	1	2.7
Flake	16	43.2
Utilized flake	1	2.7
Unifacially retouched lithic	1	2.7
Angular hammerstone	4	10.8
Mano fragment	3	8.1
Metate fragment	2	5.4
Other ground stone	3	8.1
Total	37	99.9

FB12017

	#	%
Angular lithic debitage	1	4.3
Flake	17	73.9
Core	1	4.3
Angular hammerstone	1	4.3
Metate fragment	3	13.0
Total	23	99.8

FB12069

	#	%
Angular lithic debitage	2	0.7
Flake	226	77.4
Utilized flake	21	7.2
Unimarginally retouched lithic	1	0.3
Unifacially retouched lithic	1	0.3
Bifacially retouched lithic	2	0.7
Projectile point	1	0.3
Core	5	1.7
Angular hammerstone	2	0.7
Rounded hammerstone	1	0.3
Mano fragment	3	1.0
Metate fragment	8	2.7
Mano/metate fragment	1	0.3
Other ground stone	18	6.2
Total	292	99.8

FB12072

	#	%
Undifferentiated brownware sherd	1	1.3
Angular lithic debitage	2	2.7
Tested pebble/cobble	1	1.3
Flake	40	53.3
Utilized flake	7	9.3
Unimarginally retouched lithic	1	1.3
Unifacially retouched lithic	1	1.3
Bifacially retouched lithic	1	1.3
Core	1	1.3
Angular hammerstone	1	1.3
Rounded hammerstone	1	1.3
Mano fragment	1	1.3
Metate fragment	2	2.7
Other ground stone	15	20.0
Total	75	99.7

FB12090

	#	%
Flake	1	33.3
Utilized flake	2	66.7
Total	3	100.0

FB12091 (41EP4906)

	#	%
Flake	10	100.0

FB12092

	#	%
Utilized flake	1	50.0
Bifacially retouched lithic	1	50.0
Total	2	100.0

FB12093

	#	%
Flake	1	33.3
Utilized flake	1	33.3
Core	1	33.3
Total	3	99.9

FB12095

	#	%
Angular lithic debitage	1	33.3
Flake	2	66.7
Total	3	100.0

FB12096

	#	%
Flake	8	66.7
Utilized flake	3	25.0
Unifacially retouched lithic	1	8.3
Total	12	100.0

FB12097

	#	%
Tested pebble/cobble	2	3.1
Flake	54	84.4
Utilized flake	3	4.7
Projectile point	1	1.6
Core	1	1.6
Mano fragment	1	1.6
Other ground stone	2	3.1
Total	64	100.1

FB12100

	#	%
Undifferentiated brownware sherd	76	27.5
Mimbres Transitional sherd	3	1.1
Other rim sherd sherd	1	0.4
Worked sherd	5	1.8
Angular lithic debitage	5	1.8
Utilized angular lithic debitage	1	0.4
Tested pebble/cobble	4	1.4
Flake	131	47.5
Utilized flake	11	4.0
Unimarginally retouched lithic	2	0.7
Unifacially retouched lithic	1	0.4
Projectile point	1	0.4
Core	9	3.3
Angular hammerstone	1	0.4
Rounded hammerstone	1	0.4
Mano	1	0.4
Mano fragment	4	1.4
Metate fragment	9	3.3
Other ground stone	10	3.6
Total	276	100.2

FB12102 (41EP4908)

	#	%
Undifferentiated brownware sherd	34	13.6
El Paso Brown rim sherd	3	1.2
Angular lithic debitage	4	1.6
Bipolar/tested core	1	0.4
Flake	130	52.0
Utilized flake	7	2.8
Unimarginally retouched lithic	1	0.4
Unifacially retouched lithic	2	0.8
Core	4	1.6
Angular hammerstone	1	0.4
Mano	1	0.4
Mano fragment	6	2.4
Metate fragment	28	11.2
Other ground stone	28	11.2
Total	250	100.0

FB12213

	#	%
Flake	1	10.0
Utilized flake	1	10.0
Mano	1	10.0
Metate fragment	2	20.0
Other ground stone	5	50.0
Total	10	100.0

FB12214

	#	%
Flake	19	79.2
Utilized flake	1	4.2
Unifacially retouched lithic	1	4.2
Projectile point	2	8.3
Other ground stone	1	4.2
Total	24	100.1

FB12216 (41EP4911)

	#	%
Flake	8	72.7
Unimarginally retouched lithic	1	9.1
Mano fragment	1	9.1
Other ground stone	1	9.1
Total	11	100.0

FB12217

	#	%
Angular lithic debitage	2	3.6
Bipolar/tested core	1	1.8
Flake	43	76.8

	#	%
Utilized flake	1	1.8
Mano fragment	1	1.8
Metate fragment	3	5.4
Other ground stone	5	8.9
Total	56	100.1

FB12218

	#	%
Flake	92	85.2
Utilized flake	5	4.6
Bifacially retouched lithic	1	0.9
Core	2	1.9
Angular hammerstone	1	0.9
Rounded hammerstone	2	1.9
Mano fragment	2	1.9
Metate fragment	1	0.9
Other ground stone	2	1.9
Total	108	100.1

FB12219

	#	%
Undifferentiated brownware sherd	22	10.9
Angular lithic debitage	1	0.5
Utilized angular lithic debitage	1	0.5
Flake	17	8.5
Utilized flake	1	0.5
Core	1	0.5
Angular hammerstone	1	0.5
Mano fragment	1	0.5
Metate fragment	28	13.9
Other ground stone	128	63.7
Total	201	100.0

FB12220

	#	%
Flake	1	25.0
Utilized flake	1	25.0
Core	1	25.0
Other ground stone	1	25.0
Total	4	100.0

FB12221 (41EP4912)

	#	%
Angular lithic debitage	1	1.3
Utilized angular lithic debitage	2	2.5
Flake	16	20.0
Utilized flake	4	5.0
Unimarginally retouched lithic	2	2.5
Bimarginally retouched lithic	1	1.3
Unifacially retouched lithic	1	1.3
Core	1	1.3
Mano fragment	8	10.0
Metate fragment	1	1.3
Other ground stone	43	53.7
Total	80	100.2

FB12222

	#	%
Undifferentiated brownware sherd	10	40.0
Angular lithic debitage	1	4.0
Flake	8	32.0
Unimarginally retouched lithic	1	4.0
Bimarginally retouched lithic	1	4.0
Unifacially retouched lithic	1	4.0
Angular hammerstone	1	4.0
Rounded hammerstone	1	4.0
Other ground stone	1	4.0
Total	25	100.0

FB12223

	#	%
Angular lithic debitage	1	10.0
Flake	7	70.0
Utilized flake	1	10.0
Metate fragment	1	10.0
Total	10	100.0

FB12224 (41EP4913)

	#	%
Flake	6	31.6
Utilized flake	3	15.8
Mano	1	5.3
Other ground stone	9	47.4
Total	19	100.1

FB12225 (41EP4914)

	#	%
Flake	4	50.0
Utilized flake	2	25.0
Unifacially retouched lithic	1	12.5
Metate fragment	1	12.5
Total	8	100.0

FB12226

	#	%
Flake	6	60.0
Unimarginally retouched lithic	2	20.0
Angular hammerstone	1	10.0
Metate fragment	1	10.0
Total	10	100.0

FB12228

	#	%
Angular lithic debitage	3	33.3
Flake	5	55.6
Core	1	11.1
Total	9	100.0

FB12229

	#	%
Undifferentiated brownware sherd	13	1.7
Angular lithic debitage	17	2.2
Utilized angular lithic debitage	3	0.4
Bipolar/tested core	2	0.3
Tested pebble/cobble	9	1.2
Flake	532	69.7
Utilized flake	64	8.4
Unimarginally retouched lithic	11	1.4
Bimarginally retouched lithic	1	0.1
Unifacially retouched lithic	3	0.4
Bifacially retouched lithic	6	0.8
Projectile point	2	0.3
Core	16	2.1
Angular hammerstone	8	1.0
Rounded hammerstone	1	0.1
Mano fragment	20	2.6
Metate fragment	19	2.5
Other ground stone	36	4.7
Total	763	99.9

FB12230

	#	%
Angular lithic debitage	1	10.0
Flake	3	30.0
Utilized flake	3	30.0
Projectile point	1	10.0
Rounded hammerstone	1	10.0
Mano fragment	1	10.0
Total	10	100.0

FB12231

	#	%
Undifferentiated brownware sherd	1	1.6
Angular lithic debitage	2	3.1
Flake	52	81.2
Utilized flake	3	4.7
Unimarginally retouched lithic	2	3.1
Rounded hammerstone	1	1.6
Metate fragment	1	1.6
Other ground stone	2	3.1
Total	64	100.0

FB12233

	#	%
Flake	4	44.4
Unifacially retouched lithic	1	11.1
Bifacially retouched lithic	1	11.1
Metate fragment	2	22.2
Other ground stone	1	11.1
Total	9	99.9

FB12234

Flake	4	80.0
Other ground stone	1	20.0
Total	5	100.0

FB12237

	#	%
Angular lithic debitage	1	0.8
Flake	122	93.1
Utilized flake	4	3.1
Unifacially retouched lithic	2	1.5
Core	1	0.8
Metate fragment	1	0.8
Total	131	100.1

FB12239

	#	%
Angular lithic debitage	5	3.1
Utilized angular lithic debitage	2	1.2
Bipolar/tested core	5	3.1
Flake	70	43.5
Utilized flake	9	5.6
Unimarginally retouched lithic	2	1.2
Unifacially retouched lithic	3	1.9
Core	3	1.9
Angular hammerstone	2	1.2
Rounded hammerstone	5	3.1
Mano fragment	3	1.9
Metate fragment	16	9.9
Other ground stone	36	22.4
Total	161	100.0

FB12240

	#	%
Angular lithic debitage	1	7.7
Tested pebble/cobble	1	7.7
Flake	10	76.9
Utilized flake	1	7.7
Total	13	100.0

FB12241

	#	%
Flake	13	76.5
Unifacially retouched lithic	3	17.6
Core	1	5.9
Total	17	100.0

FB12243

	#	%
Undifferentiated brownware sherd	13	26.0
El Paso Bichrome sherd	3	6.0
Angular lithic debitage	1	2.0
Utilized angular lithic debitage	1	2.0
Flake	10	20.0
Utilized flake	2	4.0
Unimarginally retouched lithic	2	4.0
Unifacially retouched lithic	2	4.0
Core	1	2.0
Rounded hammerstone	1	2.0
Mano fragment	3	6.0
Metate fragment	1	2.0
Other ground stone	10	20.0
Total	50	100.0

FB12245

	#	%
Angular lithic debitage	4	3.6
Flake	81	73.0
Utilized flake	7	6.3
Unimarginally retouched lithic	1	0.9
Unifacially retouched lithic	1	0.9
Core	5	4.5
Mano	1	0.9
Mano fragment	2	1.8
Metate fragment	2	1.8
Other ground stone	7	6.3
Total	111	100.0

FB12247

	#	%
Undifferentiated brownware sherd	18	14.9
Angular lithic debitage	1	0.8
Utilized angular lithic debitage	2	1.7
Tested pebble/cobble	3	2.5
Flake	43	35.5
Utilized flake	9	7.4
Unimarginally retouched lithic	3	2.5
Bimarginally retouched lithic	2	1.7
Unifacially retouched lithic	2	1.7
Core	2	1.7
Angular hammerstone	1	0.8
Rounded hammerstone	1	0.8
Mano	1	0.8
Mano fragment	1	0.8
Metate fragment	6	5.0
Other ground stone	26	21.5
Total	121	100.1

FB12248

	#	%
Undifferentiated brownware sherd	41	89.1
El Paso Brown rim sherd	1	2.2
Flake	4	8.7
Total	46	100.0

FB12249

	#	%
Angular lithic debitage	1	7.1
Flake	8	57.1
Unifacially retouched lithic	1	7.1
Core	2	14.3
Metate fragment	1	7.1
Other ground stone	1	7.1
Total	14	99.8

FB12252

	#	%
Undifferentiated brownware sherd	1	11.1
Angular lithic debitage	1	11.1
Flake	1	11.1
Utilized flake	1	11.1
Mano fragment	1	11.1
Metate fragment	1	11.1
Other ground stone	3	33.3
Total	9	99.9

FB12254

	#	%
Flake	12	57.1
Utilized flake	2	9.5
Unimarginally retouched lithic	1	4.8
Projectile point	1	4.8
Metate fragment	2	9.5
Other ground stone	3	14.3
Total	21	100.0

FB12256

	#	%
Other ground stone	1	100.0

FB12316

	#	%
Angular lithic debitage	2	2.0
Flake	75	74.3
Utilized flake	5	5.0
Unifacially retouched lithic	2	2.0
Angular hammerstone	2	2.0
Mano fragment	1	1.0
Metate fragment	2	2.0
Other ground stone	12	11.9
Total	101	100.2

FB12318

	#	%
Flake	8	61.5
Core	2	15.4
Rounded hammerstone	1	7.7
Metate	1	7.7
Other ground stone	1	7.7
Total	13	100.0

FB12319

	#	%
Flake	1	33.3
Utilized flake	1	33.3
Other ground stone	1	33.3
Total	3	99.9

FB12320

	#	%
Undifferentiated brownware sherd	1	4.8
Tested pebble/cobble	1	4.8
Flake	9	42.9
Utilized flake	1	4.8
Angular hammerstone	1	4.8
Mano fragment	1	4.8
Metate fragment	2	9.5
Mano/metate fragment	1	4.8
Other ground stone	4	19.0
Total	21	100.2

FB12321

	#	%
Flake	1	100.0

FB12324

	#	%
Unknown, unpainted, plain sherd	35	100.0

FB12327

	#	%
Flake	7	63.6
Utilized flake	2	18.2
Other ground stone	2	18.2
Total	11	100.0

FB12329

	#	%
Undifferentiated brownware sherd	5	83.3
Utilized flake	1	16.7
Total	6	100.0

FB12330

	#	%
Undifferentiated brownware sherd	98	33.6
El Paso Brown rim sherd	1	0.3
Worked sherd	2	0.7
Angular lithic debitage	21	7.2
Flake	145	49.7
Utilized flake	3	1.0
Unifacially retouched lithic	2	0.7
Core	3	1.0
Mano	1	0.3
Mano fragment	1	0.3
Other ground stone	15	5.1
Total	292	99.9

FB12331

	#	%
Flake	11	91.7
Bimarginally retouched lithic	1	8.3
Total	12	100.00

Appendix F

ISOLATED ARTIFACT DATA

Table F1. Ground Stone.

IF No.	Artifact Type	Raw Material	Max. Length (cm)	Max. Width (cm)	Secondary Use	Tertiary Use	No. of Surfaces	Length (cm)	Width (cm)
1	Mano/metate fragment	Quartzite	8.0	6.5	Hammerstone	None	2	0.0	0.0
4	Mano	Misc. granular	7.3	4.7	Hammerstone	None	2	5.5	4.1
7	Other	Basalt	5.6	1.9	Hearthstone	None	1	0.0	0.0
8	Metate	Misc. granular	12.4	10.7	Anvil	Hammerstone	1	8.3	7.5
11	Other	Basalt	2.6	2.1	Flake	None	1	0.0	0.0
12	Other	Misc. granular	6.7	5.4	Hammerstone	None	1	0.0	0.0
20	Other	Misc. granular	3.0	1.9	Hearthstone	None	1	0.0	0.0
21	Other	Misc. granular	4.5	3.8	Hearthstone	None	1	0.0	0.0
22	Other	Quartzite	5.8	3.6	Hearthstone	None	1	0.0	0.0
23	Other	Quartzite	4.7	3.4	Hearthstone	None	1	0.0	0.0
27	Other	Misc. granular	5.3	4.8	Hearthstone	None	1	0.0	0.0
29	Metate fragment	Misc. granular	9.1	5.2	Hearthstone	Hammerstone	2	0.0	0.0
29	Metate fragment	Misc. granular	8.0	6.7	Hearthstone	None	1	0.0	0.0
31	Metate fragment	Quartzite	10.1	9.5	Core	Hammerstone	1	0.0	0.0
41	Other	Quartzite	12.2	7.2	Hearthstone	None	2	0.0	0.0
47	Metate fragment	Quartzite	8.2	6.3	Utilized debitage	None	1	0.0	0.0
48	Other	Quartzite	4.1	2.8	Hearthstone	None	1	0.0	0.0
53	Other	Quartzite	9.9	8.3	Hearthstone	None	1	0.0	0.0
55	Mano	Misc. granular	8.1	7.3	Hammerstone	Hearthstone	1	7.0	6.5
56	Other	Quartzite	7.8	5.4	Hearthstone	None	1	0.0	0.0
58	Other	Quartzite	7.5	6.3	Utilized debitage	None	1	0.0	0.0
60	Mano/metate fragment	Quartzite	8.7	6.3	Hammerstone	Hearthstone	2	0.0	0.0
83	Mano fragment	Quartzite	7.2	5.4	Hammerstone	Hearthstone	1	0.0	0.0

(Continued on next page.)

Table F1. Ground Stone (continued).

84	Other	Franklin rhyolite	2.4	1.7	Hearthstone	None	1	0.0	0.0
91	Other	Quartzite	5.9	4.6	Hearthstone	None	1	0.0	0.0
92	Other	Basalt	2.3	1.9	Flake	None	1	0.0	0.0
94	Other	Basalt	7.5	4.7	Unimarginal retouch	None	1	0.0	0.0
101	Other	Quartzite	9.5	7.2	Hammerstone	Hearthstone	1	0.0	0.0

Table F2. Chipped Stone.

IF No.	Artifact Type	Raw Material	Grain	Level	Max. Lgth. (cm)	Max. Thick (cm)	Est. Cortex %	Plat-form Type	Secondary Use	Tertiary Use
1	Hammerstone	Quartzite	Coarse	0	9.10	0.00	75	0	Mano/metate fragment	None
2	Core	Chalcedony	Fine	0	4.70	0.00	75	0	None	None
3	Flake	Chalcedony	Fine	0	2.02	0.46	75	1	None	None
4	Hammerstone	Misc. granular	Coarse	0	7.20	0.00	75	0	Mano	None
5	Flake	Basalt	Coarse	0	1.18	0.81	0	1	None	None
5	Flake	Basalt	Coarse	0	2.68	0.78	0	1	None	None
6	Utilized flake	Other chert	Fine	0	2.93	0.54	25	1	None	None
8	Hammerstone	Misc. granular	Coarse	0	12.40	0.00	75	1	Metate	679
9	Utilized flake	Quartzite	Coarse	0	2.89	1.17	25	1	None	None
10	Flake	Misc. granular	Coarse	0	2.83	0.43	0	1	None	None
11	Flake	Basalt	Coarse	0	2.10	0.72	75	0	Other ground stone	None
12	Hammerstone	Misc. granular	Coarse	0	7.20	0.00	75	0	Other ground stone	None
13	Flake	Rancheria chert	Fine	0	4.69	1.52	25	0	None	None
14	Unimarginal retouch	Other chert	Fine	0	3.40	1.06	75	0	Medial-distal flake fragment	None
15	Flake	Basalt	Coarse	0	3.60	0.47	0	1	None	None
17	Flake	Misc. granular	Coarse	0	3.70	1.63	0	1	None	None
18	Flake	Quartzite	Coarse	0	4.18	2.09	0	1	None	None
19	Flake	Other rhyolite	Coarse	0	2.21	0.45	75	1	None	None
24	Flake	Misc. granular	Coarse	0	0.73	0.23	0	3	None	None
24	Flake	Basalt	Coarse	0	1.13	0.17	0	3	None	None
24	Flake	Basalt	Coarse	0	3.55	1.25	0	1	None	None
24	Flake	Basalt	Coarse	0	3.61	1.14	0	1	None	None
25	Flake	Quartzite	Coarse	0	3.55	1.25	0	1	None	None
26	Hammerstone	Misc. granular	Coarse	0	7.90	0.00	75	0	FCR	None

Notes:
Level: 0 = surface; 1 = below surface
Platform type: 0 = none or not applicable
1 = single facet or cortex
2 = multifaceted or ground
3 = crushed
4 = unknown

(Continued on next page.)

Table F2. Chipped Stone.

IF No.	Artifact Type	Raw Material	Grain	Level	Max. Lgth. (cm)	Max. Thick (cm)	Est. Cortex %	Plat-form Type	Secondary Use	Tertiary Use
28	Uniface retouch	Misc. granular	Coarse	0	5.00	3.09	25	1	Platform remnant-bearing flake	None
29	Hammerstone	Misc. granular	Coarse	0	9.10	0.00	25	0	Metate fragment	FCR
30	Flake	Rancheria chert	Fine	0	1.85	0.36	25	1	None	None
30	Utilized flake	Rancheria chert	Fine	0	2.60	0.57	0	0	None	None
31	Hammerstone	Quartzite	Coarse	0	12.00	0.00	75	0	Metate fragment	Multidir. core
32	Bipolar/tested core	Obsidian	Very fine	0	3.30	0.00	75	0	None	None
33	Flake	Other chert	Fine	1	0.63	0.11	0	1	None	None
34	Projectile point	Other chert	Fine	0	3.22	0.55	0	0	None	None
36	Utilized flake	Franklin rhyolite	Coarse	0	5.30	1.76	75	0	None	None
37	Utilized debitage	Franklin rhyolite	Coarse	0	7.73	5.38	75	0	None	None
38	Uniface retouch	Misc. granular	Coarse	0	5.94	0.00	75	0	None	None
39	Hammerstone	Quartzite	Very coarse	0	5.90	0.00	75	0	None	None
40	Hammerstone	Other rhyolite	Coarse	0	5.30	0.00	25	0	None	None
42	Tested pebble/ cobble	Rancheria chert	Fine	0	4.30	2.20	75	0	None	None
43	Uniface retouch	Silic. limestone	Coarse	0	7.27	2.67	25	0	Medial-distal flake fragment.	None
44	Hammerstone	Quartzite	Coarse	0	13.00	0.00	75	0	None	None
45	Flake	Quartzite	Coarse	0	4.12	1.31	25	1	None	None
46	Flake	Basalt	Coarse	0	3.30	0.84	0	0	None	None
47	Utilized debitage	Quartzite	Coarse	0	8.13	1.57	25	0	Metate fragment	None
49	Flake	Other chert	Fine	0	2.78	1.30	25	1	None	
51	Hammerstone	Silic. limestone	Coarse	0	7.50	0.00	75	0	None	None
52	Utilized flake	Silic. limestone	Fine	0	2.43	0.81	75	3	None	None
54	Core	Rancheria chert	Fine	0	4.80	0.00	75	0	None	None
55	Hammerstone	Misc. granular	Very coarse	0	8.10	0.00	75	0	Mano	None
56	Hammerstone	Quartzite	Coarse	0	7.80	0.00	75	0	Other ground stone	FCR
58	Utilized debitage	Quartzite	Coarse	0	5.90	1.03	25	0	Other ground stone	None
59	Utilized debitage	Misc. granular	Coarse	0	11.80	2.28	75	0	None	None
60	Hammerstone	Quartzite	Coarse	0	8.70	0.00	75	0	Mano/metate fragment.	FCR
61	Utilized flake	Misc. granular	Coarse	0	4.57	1.44	75	0	None	None
62	Utilized debitage	Quartzite	Coarse	0	7.54	3.28	25	0	FCR	None
63	Hammerstone	Quartzite	Coarse	0	6.40	0.00	25	0	FCR	None
64	Flake	Rancheria chert	Fine	0	1.80	0.34	75	1	None	None
65	Core	Obsidian	Very fine	0	3.00	0.00	75	0	None	None

(Continued on next page.)

Table F2. Chipped Stone.

IF No.	Artifact Type	Raw Material	Grain	Level	Max. Lgth. (cm)	Max. Thick (cm)	Est. Cortex %	Plat-form Type	Secondary Use	Tertiary Use
66	Flake	Quartzite	Coarse	0	1.22	0.20	0	0	None	None
67	Core	Other chert	Fine	0	3.50	0.00	25	0	None	None
68	Utilized debitage	Misc. granular	Coarse	0	5.88	2.14	75	0	None	None
70	Hammerstone	Quartzite	Coarse	0	7.60	0.00	75	0	None	None
83	Hammerstone	Quartzite	Coarse	0	7.20	0.00	75	0	Mano fragment	None
85	Hammerstone	Basalt	Coarse	0	9.40	0.00	75	0	FCR	None
88	Tested pebble/ cobble	Other chert	Very fine	0	7.60	0.00	75	0	None	None
89	Tested pebble/ cobble	Quartzite	Coarse	0	6.33	2.61	25	0	None	None
90	Hammerstone	Franklin rhyolite	Coarse	0	9.00	0.00	75	0	FCR	None
92	Flake	Basalt	Coarse	0	2.04	0.92	25	1	Other ground stone	None
93	Hammerstone	Misc. granular	Very coarse	0	3.40	0.00	25	0	FCR	None
94	Unimarginal. retouch	Basalt	Coarse	0	7.41	1.53	25	1	Platform remnant-bearing flake	Other ground stone
95	Flake	Misc. granular	Coarse	0	3.96	0.55	25	1	None	None
97	Hammerstone	Quartzite	Coarse	0	7.40	0.00	25	0	None	None
98	Flake	Misc. granular	Coarse	0	3.09	0.77	25	1	None	None
99	Flake	Other rhyolite	Coarse	0	2.21	0.39	25	1	None	None
100	Hammerstone	Franklin rhyolite	Coarse	0	9.60	0.00	25	0	FCR	None
101	Hammerstone	Quartzite	Coarse	0	9.50	0.00	25	0	Other ground stone	FCR
102	Biface retouch	Other chert	Fine	0	2.80	1.02	25	0	None	None
103	Core	Other chert	Fine	0	3.90	0.00	75	0	None	None
104	Utilized flake	Quartzite	Coarse	0	4.25	1.13	0	1	None	None
1087	Biface retouch	Other chert	Fine	0	4.72	0.80	0	0	None	None

Table F3. Ceramic Sherds.

FB IF No.	Extension	Artifact Type	Form	Size Range (cm)	Weight (gr)
69	0	Undifferentiated brownware	Jar	4–5	9.1
71	0	Undifferentiated brownware	Bowl	2–3	2.2
72	0	Undifferentiated brownware	Jar	2–3	3.6
73	0	Undifferentiated brownware	Jar	2–3	0.6
74	0	Undifferentiated brownware	Jar	2–3	2.6
75	0	Undifferentiated brownware	Jar	2–3	2.0
76	0	Undifferentiated brownware	Jar	1–2	0.9
77	0	Undifferentiated brownware	Jar	1–2	0.9
78	1	Undifferentiated brownware	Bowl	3–4	5.0
78	2	Undifferentiated brownware	Bowl	2–3	2.4
78	3	Undifferentiated brownware	Jar	3–4	2.5
78	4	Undifferentiated brownware	Jar	2–3	1.2
79	1	Undifferentiated brownware	Jar	4–5	4.1
79	2	Undifferentiated brownware	Bowl	3–4	2.9
79	3	Undifferentiated brownware	Jar	2–3	2.4
79	4	Undifferentiated brownware	Jar	2–3	2.6
79	5	Undifferentiated brownware	Jar	1–2	1.0
80	0	Undifferentiated brownware	Jar	1–2	1.0
81	0	Undifferentiated brownware	Jar	2–3	1.8
82	0	Undifferentiated brownware	Bowl	1–2	0.6
86	0	El Paso Brown rim	Jar	4–5	14.0
87	0	Undifferentiated brownware	Jar	2–3	4.5
96	0	Undifferentiated brownware	Jar	3–4	6.2

Appendix G

ATTRIBUTES OF TESTED FEATURES

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
6741	2	BC, stain	Basin	Circular	40	40	13	10.89
6741	3	BC	–	–	–	–	–	–
6741	5	BC, FCR, stain	Basin	Amorphous	60	50	13	–
6741	6	BC	–	–	–	–	–	–
6741	7	Stain	Basin	Amorphous	50	45	9	–
6741	43	BC	–	–	–	–	–	–
6741	52	BC	–	–	–	–	–	–
6741	69	BC, stain	Basin	Circular	43	33	5	3.78
6741	100	BC, FCR, stain	Basin	Oval	40	40	11	9.22
6741	102	BC, FCR	–	–	–	–	–	–
6741	106	BC, FCR	–	–	–	–	–	–
6741	130	BC	–	–	–	–	–	–
6741	133	BC, FCR, stain	Basin	Oval	174	150	8	109.93
6741	134	Large stain	Amorphous	Amorphous	200	200	–	–
6741	135	FCR, stain	Basin	Circular	129	128	25	216.15
6741	136	Stain	Cylinder	Circular	20	20	20	25.13
6741	137	Stain	Basin	Circular	70	70	14	35.92
6741	144	Stain	Basin	Oval	24	16	3	0.63
6741	145	Stain	Basin	Circular	68	60	12	25.74
6741	147	BC, stain	Basin	Circular	26	20	4	1.11
6741	148	Stain	Amorphous	Amorphous	50	38	33	–
6741	149	BC, stain	Basin	Circular	14	14	2	0.21
6741	150	Stain	Basin	Oval	35	12	3	0.87
6741	151	BC, stain	Basin	Circular	17	15	4	0.54

BC = burned caliche
FCR = fire-cracked rock

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
6741	152	BC, FCR, stain	Basin	Circular	30	30	22	10.37
6741	153	BC, FCR, stain	Basin	Circular	35	37	24	16.29
6741	154	BC, FCR, stain	Basin	Circular	60	64	4	8.05
6741	155	FCR, stain	Basin	Oval	32	51	8	7.21
6741	156	BC, FCR	–	–	–	–	–	–
6741	158	BC, stain	Basin	Circular	60	60	14	26.39
;6741	159	Small stain	Basin	Circular	50	50	18	23.56
7483	1	BC, stain	Basin	Circular	80	90	6	22.70
7483	2	BC, FCR, stain	Basin	Oval	50	100	12	35.34
7483	4	BC, stain	Basin	Circular	68	55	19	37.63
7483	5	Small stain	Basin	Circular	140	140	22	255.78
7483	6	BC, stain	Basin	Oval	125	95	20	126.71
7483	7	BC, FCR, stain	Basin	Oval	138	102	16	120.64
7483	8	BC, FCR, stain	Lens	Amorphous	188	174	2	–
7483	9	BC, FCR, stain	Lens	Oval	65	85	12	–
7483	10	BC, FCR, stain	Lens	Oval	160	140	13	–
7483	11	BC, stain	Cylinder	Circular	22	22	23	34.97
7483	12	BC, stain	Basin	Oval	74	67	5	39.04
7483	13	BC, stain	Basin	Oval	73	54	11	23.22
7483	14	BC, FCR, stain	Basin	Circular	97	90	24	104.86
7483	15	BC, FCR, stain	Basin	Oval	38	60	8	10.06
7483	16	Small stain	Basin	Circular	158	152	37	465.44
7483	17	Small stain	Basin	Circular	75	60	10	23.86
7483	18	Small stain	Basin	Circular	188	178	30	526.05
7483	19	Small stain	Basin	Circular	62	62	36	72.46
7483	20	BC	–	–	–	–	–	–
7483	21	BC	–	–	–	–	–	–
7483	22	BC, stain	Amorphous	Amorphous	125	88	8	–
7483	23	Small stain	Basin	Circular	130	140	12	114.51
7483	24	Small stain	Basin	Circular	35	45	15	12.57

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
7483	25	BC, FCR	–	–	–	–	–	–
7483	26	BC, stain	Basin	Circular	40	40	4	3.35
7483	27	Small stain	Basin	Circular	45	43	12	12.16
7483	28	Small stain	Basin	Amorphous	100	200	14	–
7483	29	FCR, stain	Lens	Amorphous	40	50	1	–
7483	30	BC, FCR, stain	Basin	Amorphous	200	165	17	–
7483	31	BC, FCR, stain	Basin	Amorphous	275	250	4	–
7483	32	Small stain	Basin	Circular	64	56	16	30.16
7483	33	BC, stain	Basin	Circular	50	50	13	17.02
7483	34	BC, FCR, stain	Basin	Oval	40	20	3	1.41
7483	35	Small stain	Cylinder	Circular	22	20	5	6.92
7483	36	BC, stain	Basin	Circular	74	85	17	56.26
7483	37	BC	–	Oval	100	52	25	–
7483	38	BC, stain	Basin	Circular	86	90	16	64.87
7483	39	Small stain	Basin	Oval	78	65	13	34.80
7483	43	Small stain	Basin	Circular	120	132	20	166.25
7483	44	Small stain	Basin	Circular	63	48	15	24.19
7484	23	BC, stain	Basin	Circular	30	27	22	9.36
7484	24	BC, FCR, stain	Basin	Oval	47	30	7	5.43
7484	25	BC, stain	Basin	Circular	20	24	4	1.01
7484	29	Small stain	Amorphous	Amorphous	33	43	14	–
;7484	30	Small stain	Amorphous	Amorphous	122	100	8	–
7484	33	BC, stain	Basin	Circular	22	19	8	1.76
7484	34	Small stain	Basin	Oval	36	52	7	7.96
7505	6	BC, FCR	–	Oval	300	200	6	–
7508	7	FCR, stain	Basin	Circular	140	140	19	194.99
7508	14	BC	–	Oval	45	35	–	–
7508	22	BC	–	–	–	–	–	–
7510	18	BC, stain	Basin	Oval	70	60	12	26.55
7510	23	Small stain	Basin	Amorphous	73	57	28	–
7510	38	BC, stain	Basin	Oval	92	74	12	43.29

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
7510	39	Small stain	Basin	Circular	100	100	10	52.36
7510	40	BC, stain	Basin	Circular	80	80	24	80.43
7510	45	Small stain	Basin	Oval	74	60	10	23.50
7510	52	BC, FCR, stain	Basin	Circular	35	38	16	11.16
7510	68	Small stain	Basin	Circular	92	80	14	54.22
7510	70	FCR, stain	Basin	Circular	10	10	2	0.10
7510	71	BC, FCR, stain	Basin	Oval	40	35	7	5.15
7510	72	BC, stain	Basin	Amorphous	60	85	19	–
7510	74	BC, stain	Basin	Circular	77	76	14	42.90
7517	27	Small stain	Basin	Circular	64	57	8	15.33
7517	28	Small stain	Basin	Circular	24	23	3	0.87
7517	29	Small stain	Lens	Circular	28	25	2	–
7517	39	BC, stain	Basin	Circular	140	140	9	92.36
7517	45	BC, stain	Basin	Circular	60	65	10	20.45
7517	49	Small stain	Basin	Circular	29	29	4	1.76
7520	2	Small stain	Basin	Circular	108	101	9	51.46
7520	27	BC, FCR	–	–	85	50	–	–
7520	29	BC, stain	Lens	Amorphous	78	65	1	–
7520	43	Small stain	Basin	Oval	24	42	10	5.70
7520	67	Small stain	Lens	Amorphous	75	50	1	–
7547	3	BC, stain	Basin	Circular	80	70	14	41.23
7547	29	BC, FCR	–	–	–	–	–	–
7547	54	FCR, stain	Basin	Circular	150	148	13	151.12
7547	85	BC, FCR, stain	Basin	Circular	30	30	11	5.18
7547	86	BC, FCR, stain	Basin	Circular	50	54	12	16.99
7547	92	BC, FCR, stain	Basin	Oval	120	95	8	48.41
7547	96	BC, FCR, stain	Basin	Circular	58	55	12	20.06
7569	11	Small stain	Basin	Circular	44	50	7	8.09
7569	12	Small stain	Basin	Circular	31	28	14	6.38
7580	1	Small stain	Basin	Circular	88	95	9	39.45

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FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
7580	4	Small stain	Basin	Circular	50	42	11	12.19
7580	5	BC, stain	Basin	Amorphous	62	60	18	–
7580	6	Small stain	Basin	Circular	90	100	10	47.25
7580	7	Small stain	Lens	Circular	50	48	5	–
7580	8	Small stain	Basin	Circular	74	72	12	33.48
7580	9	BC, stain	Lens	Circular	40	43	4	–
7580	11	FCR, stain	Basin	Oval	64	48	5	8.21
7580	13	BC	–	–	–	–	–	–
7580	26	Small stain	Basin	Circular	90	90	4	16.96
7580	28	Small stain	Lens	Circular	55	55	5	–
7580	29	BC, stain	Lens	Oval	54	40	3	–
10408	1	BC, FCR	–	–	–	–	–	–
10409	1	BC, stain	Basin	Circular	98	95	9	43.88
10409	2	Modern	Basin	Circular	23	18	25	5.50
10411	1	BC, FCR, stain	Lens	Circular	15	15	30	–
10411	2	BC, stain	Amorphous	Amorphous	40	15	–	–
10411	3	BC, stain	Amorphous	Amorphous	10	10	–	–
10411	9	Small stain	Basin	Circular	30	28	5	2.20
10411	11	BC, stain	Basin	Oval	43	67	10	15.84
10411	12	Small stain	Basin	Circular	24	20	6	1.52
10411	16	Large stain	Basin	Unknown	275	?	63	–
10411	17	Small stain	Amorphous	Amorphous	90	55	10	–
10411	18	Small stain	Basin	Circular	20	20	6	1.26
10412	1	Modern	Basin	Circular	15	15	4	0.47
10412	2	Modern	Basin	Circular	15	15	3	0.35
10413	1	FCR, stain	Basin	Oval	44	32	13	9.07
10414	1	BC, FCR, stain	Basin	Circular	47	46	6	6.79
10416	1	BC, FCR	–	–	–	–	–	–
10416	2	Small stain	Amorphous	Oval	75	25	21	–
10417	1	BC, FCR	–	–	–	–	–	–
10417	2	FCR, stain	Lens	Oval	26	20	2	–

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
10417	4	Small stain	Lens	Oval	55	30	2	–
10417	5	Small stain	Basin	Circular	30	30	6	2.83
10420	1	FCR	–	Oval	70	50	5	–
11298	1	BC, stain	Cylinder	Oval	26	20	46	109.29
11298	2	BC, FCR	–	–	–	–	–	–
11298	3	BC, stain	Cylinder	Circular	17	20	19	20.43
11299	9	Small stain	Basin	Circular	83	82	10	35.64
12017	1	BC, FCR, stain	Basin	Circular	20	21	8	1.76
12069	7	BC, stain	Basin	Circular	78	70	3	8.60
12069	14	BC, stain	Basin/ cylinder	Amorphous	44	41	24	–
12069	15	Small stain	Basin	Oval	50	70	14	26.39
12069	16	Large stain	Basin	Oval	430	405	13	–
12069	17	Small stain	Basin	Oval	140	130	18	171.77
12069	18	BC, stain	Basin	Circular	40	37	11	8.54
12069	19	Small stain	Cylinder	Circular	30	30	26+	–
12069	20	Small stain	Basin	Oval	50	34	8	7.39
12069	21	Small stain	Basin	Oval	20	15	9	1.44
12069	22	Small stain	Basin	Circular	132	132	19	173.34
12069	23	Small stain	Cylinder	Circular	14	14	5	3.08
12069	24	Small stain	Cylinder	Circular	12	12	12	5.43
12072	6	Small stain	Basin	Circular	80	82	24	82.45
12072	7	Small stain	Basin	Circular	37	33	9	5.77
12072	11	Small stain	Amorphous	Oval	50	62	33	–
12072	12	BC, stain	Amorphous	Amorphous	95	92	6	–
12072	15	Large stain	Basin	Oval	351	211	8	–
12072	17	Small stain	Basin	Oval	42	67	7	10.89
12072	18	Small stain	Basin	Oval	39	33	6	4.07
12072	17	Small stain	Basin	Oval	42	67	7	10.89
12072	18	Small stain	Basin	Oval	39	33	6	4.07
12072	19	Small stain	Basin	Circular	16	18	5	0.76
12072	20	Small stain	Basin	Oval	74	169	19	146.86

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FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
12072	21	Small stain	Lens	Circular	8	8	–	–
12072	22	Small stain	Lens	Circular	8	7	–	–
12072	23	Small stain	Lens	Oval	10	15	10	–
12093	1	Burned caliche	–	–	–	–	–	–
12095	1	Burned caliche	–	–	–	–	–	–
12096	1	BC, FCR	–	–	–	–	–	–
12097	1	BC	–	–	–	–	–	–
12097	2	BC	–	–	–	–	–	–
12097	3	Small stain	Cylinder	Circular	20	20	75	94.25
12100	1	Large stain	Lens	Amorphous	400	550	19	–
12100	2	BC, stain	Basin	Circular	50	50	7	9.16
12100	3	BC, stain	Basin	Amorphous	98	95	10	–
12100	4	BC, FCR, stain	Lens	Amorphous	122	155	1	–
12100	5	BC, stain	Lens	Amorphous	190	175	25	–
12100	6	BC, stain	Basin	Amorphous	–	–	5	–
12100	7	BC, FCR, stain	Basin	Circular	95	100	43	214.03
12100	8	FCR, stain	Basin	Circular	100	100	20	104.72
12100	26	Small stain	Basin	Oval	43	38	9	7.73
12100	27	Large stain	Basin	Oval	482	234	30	–
12100	29	BC, stain	Basin	Circular	23	22	16	4.24
12100	31	Small stain	Basin	Circular	70	62	19	43.34
12100	32	Small stain	Basin	Circular	70	66	23	55.69
12100	33	Small stain	Cylinder	Circular	10	10	6	1.88
12100	34	Small stain	Basin	Circular	24	23	5	1.45
12100	35	Small stain	Basin/ cylinder	Oval	38	28	12	6.84
12100	36	Small stain	Basin	Circular	30	28	12	5.28
12100	37	Small stain	Basin/ cylinder	Oval	36	34	16	10.26
12100	38	Small stain	Basin	Circular	18	17	5	0.80
12100	39	Small stain	Basin	Circular	26	26	12	4.25
12100	40	Small stain	Lens	Oval	29	26	2	–
12100	41	Small stain	Basin	Circular	24	22	14	3.88

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FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
12100	42	Small stain	Basin	Circular	20	20	14	2.93
12100	43	Small stain	Basin	Circular	42	36	7	5.57
12100	44	Small stain	Basin	Circular	29	27	10.	4.11
12100	45	Small stain	Basin	Circular	26	25	9	3.06
12100	46	Small stain	Basin	Oval	41	25	8	4.56
12100	47	Small stain	Basin	Circular	20	18	8	1.51
12100	48	Small stain	Basin	Circular	29	21	8	2.62
12100	49	Small stain	Basin	Circular	32	28	6	2.83
12100	50	Small stain	Basin	Circular	27	27	6	2.29
12100	51	BC	–	–	–	–	–	–
12102	1	BC, stain	Amorphous	Amorphous	120	120	10	–
12102	2	BC, FCR, stain	Amorphous	Oval	165	113	10	–
12102	3	BC, stain	Basin	Oval	128	145	16	156.09
12102	4	BC, stain	Basin	Circular	45	50	4	4.73
12102	5	BC	–	–	–	–	–	–
12102	6	BC, FCR	–	–	–	–	–	–
12102	7	BC, FCR	–	–	–	–	–	–
12102	8	BC, FCR, stain	Lens	Oval	125	120	2	–
12102	9	BC, FCR, stain	Lens	–	–	205	160	27.00
12102	11	BC, stain	–	–	–	–	–	–
12213	1	FCR	–	Oval	110	120	–	–
12216	1	BC	–	–	–	–	–	–
12216	2	BC, stain	Basin	Amorphous	15	25	16	–
12216	3	BC, stain	Basin	Circular	20	20	11	2.30
12217	1	BC	–	–	–	–	–	–
12217	2	BC, stain	Lens	Circular	17	20	7	–
12217	3	Small stain	Basin	Circular	32	28	6	2.83
12218	1	BC, FCR	–	–	–	–	–	–
12218	2	BC, FCR	–	–	–	–	–	–
12218	3	BC	–	–	–	–	–	–
12218	4	Small stain	Basin	Circular	60	60	19	35.81

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
12218	5	BC, stain	Lens	Circular	10	10	7	–
12218	6	BC	–	–	–	–	–	–
12219	1	BC, FCR, stain	Lens	Oval	60	45	1	–
12219	2	BC, FCR, stain	Basin	Oval	53	27	6	5.03
12219	3	Small stain	Basin	Oval	75	125	18	94.25
12219	4	Small stain	Basin	Circular	25	25	8	2.62
12221	2	BC, FCR, stain	Basin	Circular	40	33	9	6.28
12224	1	BC	–	Oval	250	180	14	–
12224	4	Small stain	Basin	Oval	112	138	36	294.53
12225	1	Small stain	Basin	Circular	90	90	17	72.10
12225	2	Small stain	Basin	Circular	92	85	12	49.21
12225	3	Small stain	Basin	Unknown	56	?	16	–
12225	4	Small stain	Basin	Oval	130	78	5	28.32
12226	1	BC, stain	Basin	Circular	42	39	7	6.01
12226	2	Small stain	Basin	Circular	13	13	7	0.62
12227	1	BC	–	–	–	–	–	–
12228	1	BC	–	–	–	–	–	–
12229	2	BC, stain	Amorphous	Amorphous	40	80	11	–
12229	17	FCR, stain	Basin	Oval	37	47	10	9.24
12230	1	BC	–	Oval	220	200	14	–
12234	1	Small stain	Basin	Circular	40	36	10	7.56
12234	2	Small stain	Lens	Amorphous	30	28	2	–
12237	1	Small stain	Basin	Oval	36	24	9	4.24
12239	7	BC, FCR	–	Oval	260	210	–	–
12240	2	Small stain	Basin	Circular	140	150	10	110.09
12240	3	Modern	Lens	Amorphous	27	24	1	–
12243	1	BC, FCR, stain	Basin	Circular	96	96	13	62.73
12243	4	BC, FCR, stain	Amorphous	Amorphous	69	43	17	–
12243	8	BC, FCR	–	–	–	–	–	–
12243	17	BC, stain	Basin	Circular	36	40	14	10.59

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
12245	1	BC, stain	Basin	Circular	40	35	5	3.68
12253	1	Modern	Amorphous	Amorphous	–	–	–	–
12256	1	BC, stain	Basin	Circular	35	40	6	4.42
12316	1	BC, FCR	–	–	–	–	–	–
12316	2	BC, FCR	–	–	–	–	–	–
12316	3	Modern	Amorphous	Amorphous	65	70	6	–
12316	4	Modern	Amorphous	Amorphous	65	80	8	–
12316	5	Modern	Lens	Amorphous	–	–	–	–
12316	6	Small stain	Cylinder	Circular	18	17	58+	–
12316	8	Small stain	Basin	Circular	65	62	11	23.22
12316	9	Small stain	Basin	Oval	180	98	12	121.40
12316	10	BC, FCR, stain	Basin	Circular	25	25	5	1.64
12318	1	Modern	–	–	–	–	–	–
12319	1	Small stain	Lens	Circular	30	30	4	–
12319	2	Small stain	Basin	Oval	120	68	20	–
12320	1	BC, FCR, stain	Lens	Circular	60	60	1	–
12321	1	Modern	Lens	Oval	70	50	2	–
12321	4	Modern	Lens	Circular	34	30	2	–
12324	1	Modern	Amorphous	Circular	24	40	5	–
12324	2	Modern	Amorphous	Amorphous	24	55	23	–
12326	1	Small stain	Basin	Oval	100	145	6	47.14
12327	1	Small stain	Lens	Circular	19	16	3	–
12329	2	BC, FCR	–	–	–	–	–	–
12330	1	BC, stain	Basin	Oval	65	106	12	45.93
12330	2	Small stain	Basin	Oval	60	45	17	24.53
12330	3	BC, FCR, stain	Basin	Circular	100	95	23	114.48
12330	4	Small stain	Basin	Oval	50	32	11	9.68
12330	5	BC, stain	Cylinder	Circular	20	20	13	16.34
12330	6	Small stain	Basin	Oval	73	39	16	26.27
12330	7	Large stain	Basin	Circular	185	158	29	–
12330	8	Small stain	Cylinder	Circular	12	13	11	5.40

(Continued on next page.)

FB No.	Feature No.	Feature Type	Cross Section	Surface Shape	Length (cm)	Width (cm)	Depth (cm)	Volume (liters)
12330	9	Small stain	Lens	Amorphous	60	40	1	–
12330	10	Small stain	Basin	Oval	16	11	7	0.67
12330	11	Small stain	Basin	Circular	19	18	6	1.08
12330	12	Small stain	Basin	Circular	48	47	6	7.09
12330	13	Small stain	Cylinder	Circular	16	14	11	7.78
12331	1	BC, stain	Basin	Oval	70	33	18	24.99
12331	2	BC, stain	Basin	Circular	20	20	16	3.35
12331	3	BC, stain	Basin	Oval	87	55	17	44.87
12331	4	BC, stain	Cylinder	Oval	37	27	15	48.26
12331	5	Small stain	Basin	Oval	37	30	10	5.88

Appendix H

IMMUNOLOGICAL ANALYSIS OF ARTIFACTS FROM FORT BLISS, TEXAS, (Project 90-11)

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Studies have demonstrated that lithic artifacts often retain traces of organic residue resulting from their original use (Briuer 1976; Broderick 1979; Downs 1985; Hyland et al. 1990; Kooyman et al. 1992; Newman 1990; Newman and Julig 1989; Newman et al. 1992; Shafer and Holloway 1979; Yohe et al. 1991). Through the use of immunological and biochemical techniques the animal and/or plant of origin can be identified to at least the family level. This information can be used in the reconstruction of prehistoric subsistence patterns and possibly in identifying artifacts used for specific tasks.

Immunological tests have been used for many years to characterize bloodstains in medico-legal work. Since the introduction of the precipitin test for the medico-legal identification of blood stains at the turn of the century (Culliford 1964; Gaensslen 1983), several new techniques have been introduced. However, the basis of all subsequent tests is the antigen-antibody reaction first observed in the classic precipitin test (Gaensslen 1983: 53). The successful identification of such residues is dependent on the amount and condition of antigen retained in the stain. Nevertheless, forensic studies have demonstrated that blood proteins can generally withstand harsh treatment and still be identified (Gaensslen 1983; Macey 1979; Sensabaugh et al. 1971, among others). The sensitivity and specificity of precipitin reactions make them an extremely effective method for the detection of trace amounts of protein (Kabat and Meyer 1967: 22).

Materials and Methods

The method of analysis used in this laboratory is cross-over electrophoresis (CIEP). This is based on the work of Culliford (1964) with minor changes made following the methods of the Royal Canadian Mounted Police (RCM Police) Serology Laboratory (Ottawa) and the Centre of Forensic Sciences (Toronto). This procedure is discussed fully in Newman and Julig (1989).

Seventy flaked lithic artifacts recovered from 25 sites on Fort Bliss, Texas, were submitted for protein residue analysis. With one exception, an isolated artifact (IF51884), control soil samples from each site were sent with the artifacts. As soil contaminants such as bacteria, tannic acid, and iron chlorates may result in nonspecific precipitation of antisera, it is important that soils are included in the analysis (Gaensslen 1983).

Possible residues were removed from the artifacts by the use of 5% ammonium hydroxide solution. This has been shown to be the most effective extractant for old and denatured bloodstains and does not interfere with subsequent testing (Dorril and Whitehead 1979; Kind and Cleevely 1969). Artifacts were placed in shallow plastic dishes and 0.5 cc

of the 5% ammonia solution applied with a syringe and needle. Initial disaggregation of residue is carried out by floating the plastic dish and its contents in an ultrasonic cleaning bath for 2 to 3 minutes. Extraction is continued by placing the boat and contents on a rotating mixer for 30 minutes. The resulting ammonia solution is removed with a pipette and placed in a numbered plastic vial and refrigerated prior to further testing.

Approximately 1 milliliter of Tris buffer (ph 8.0) was added to each soil sample. Samples were mixed well and allowed to extract for 24 hours at 4 degrees C to prevent bacterial contamination. The resulting supernatant fluids were removed and tested against pre-immune serum.

All artifact and soil extracts were first tested against pre-immune serum (i.e., serum from a non-immunized animal). A positive result against pre-immune serum could arise from a nonspecific protein interaction not based on the immunological specificity of the antibody (i.e., nonspecific precipitation). No positive results were obtained. All extracts were then tested against the antisera (Table H1). Duplicate testing was carried out on all positive reacting specimens.

Table H1. Antisera Used in Analysis.

Antisera	Source
Anti-deer	Organon Teknika
Anti-sheep	Forensic medicine
Anti-cat	
Anti-dog	
Anti-mouse	
Anti-rat	
Anti-guinea-pig	
Anti-bouvine	
Anti-rabbit	
Anti-human	
Anti-bear	
Anti-turkey	Nordic Immunological
Anti-pronghorn	University of Calgary
Anti-elk	

Except where noted, the animal antisera used in this analysis were obtained from commercial sources and were developed specifically for use in forensic medicine. These sera are polyclonal, that is, they recognize epitopes shared by closely related species. For example, anti-deer will give positive results with other members of the Cervidae family such as deer, moose, elk, and caribou, as well as with the pronghorn (Antilocapridae family). Two antisera, pronghorn and elk, raised at the University of Calgary, are species-specific. Immunological relationships do not necessarily bear any relationship to the Linnaean classification scheme although they usually do (Gaensslen 1983).

Results

The positive results obtained in CIEP analysis are presented in Table H2 and discussed below.

Table H2. Positive Results of CIEP Analysis.

Site and Artifact #	Result
6741-77	Deer
6741-996	Deer
6741-320	Rabbit
7843-103	Human
7484-249	Dog
7510-525	Deer
7510-203	Dog
7510-475	Deer
7510-577	Guinea-pig
7510-658	Mouse
7520-382	Guinea-pig
10407-7	Guinea-pig
11460-32	Rabbit, mouse (+/-)
12229-535	Dog
12254-24	Rat
12556-36	Turkey

Positive results to deer antiserum were obtained on four artifacts. As negative reactions to elk and pronghorn antisera were obtained from these artifacts it is suggested that deer (*Odocoileus* sp.) are represented by these results.

Three artifacts tested positive to dog antiserum. Any member of the Canidae family, such as coyote, fox, or dog, may be represented by these results. Cross-reactions with other families do not occur.

Positive reactions to rabbit were obtained on two artifacts while a week positive to mouse antiserum was also obtained on one (11460-32). Other members of the order Lagomorpha (rabbits, hares, or pikas) may be represented by these results. Although cross-reactions with other orders do not normally occur, the weakness of the reaction to mouse antiserum indicates that this is a possible cross-reaction.

A positive result to human antiserum was obtained on one artifact. Positive results to this antiserum are obtained only with humans and apes. Unless this result represents prehistoric crime, the most likely explanation is that it represents accidental cuts incurred during use and/or manufacture of the artifacts. It is also possible that skin oils or perspiration from recent handling is responsible for those results; however, if this were true then more positive results would be expected.

Positive results to guinea pig antiserum were obtained on three artifacts. Several families within the order Rodentia could be represented by these results. Strong positive results to porcupine (Erethizontidae) are known to occur with this antiserum while weak reactions to beaver and red squirrel also occur. However, these results probably represent the processing of porcupine.

The order Rodentia is represented by two positive reactions, one to mouse and the other to rat antiserum. This implies the hunting and/or processing of rodents, the specific identification of which cannot presently be made.

A positive result to turkey antiserum was elicited from one artifact. Other families within the order Galliformes may be represented by this result such as chicken, grouse, pheasant, or quail. Cross-reactions with other orders do not generally occur.

The absence of identifiable proteins on other artifacts may be due to poor preservation of protein or that artifacts were used on species other than those covered by the antisera. It is also possible that the artifacts were not utilized.

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Appendix I

FAUNAL REMAINS
Small Sites Archaeological Project 90 -11 Fort Bliss, Texas

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INTRODUCTION

This report summarizes information for faunal remains recovered from the Small Sites Archeological Project 90-11, Maneuver Area 1, Fort Bliss, Texas. The total faunal assemblage (composed of 33 different sites: FB6741, 7483, 7510, 7517, 7520, 7547, 7569, 10411, 10413, 10416, 10417, 11299, 12017, 12069, 12097, 12100, 12102, 12213, 12216, 12217, 12219, 12225, 12237, 12239, 12240, 12247, 12254, 12316, 12319, 12330, 12331) consisted of 1,317 bones. Summary information on the analyzed faunal materials is presented in Table I1. This information breaks down taxonomic representation by site and element and further summarizes the information on cultural modification (e.g., evidence for burning, etc.).

The following section covers the methods and terminology employed in the analysis. A descriptive summary of the materials found identifiable to genus or species level of identification is also included.

METHODS AND TERMINOLOGY

The comparative collections at the Museum of Southwest Biology at the University of New Mexico, Albuquerque, were utilized to make taxonomic levels of identification. When it was not possible to make specific generic identifications, family levels of identification were made. To provide some level of identification for fragmented specimens, ribs, vertebrae, and phalanges, the categories of small, medium, and large mammal or bird were utilized. Small mammal refers to mammals smaller than the genus *Sylvilagus* (cottontail rabbit). Medium mammals are those ranging between *Sylvilagus* and *Canis* (coyote, dog) in size. Large mammals are those larger than *Canis*. Small bird refers to sparrow-sized birds. Medium bird refers to birds larger than sparrows and up to the size of Corvids (crows and ravens). Large bird refers to birds larger than Corvids. These categories are used as convenient groups for the purpose of assigning bone that could not be more precisely identified. Specific or generic identifications of rodent phalanges, vertebrae, or ribs when complete are difficult at best (Klein and Cruz-Uribe 1984); and this was not undertaken.

The number of identified specimens (NISP), was the unit of quantification employed. The NISP measurement was chosen because of the problems inherent in the calculations of maximum number of individuals MNIs (Grayson 1984). To make more meaningful comparisons, specific or generic level

identifications were grouped together with identifications that bore "cf." (compare favorably) level identifications. For example, counts of specimens identified as *Dipodomys ordi* were summed with specimens originally identified as cf. *Dipodomys ordi*, resulting in larger sample sizes for analytic purposes.

DESCRIPTIVE SUMMARY

Order Artiodactyla

Artiodactyl

Family Cervidae
Deer

cf. Artiodactyl
Materials: 1 metapodial

Odocoileus hemionus
Black-tail or mule deer
Materials: 1 naviculo-cuboid

Order Lagomorpha

Rabbits, hares and pikas
Family Leporidae—Rabbits and hares

Leporidae
Materials: 2 skull, 16 teeth

Lepus sp.
Jackrabbit
Materials: 4 calcaneum, 1 cuneiform, 1 femur, 8 humeri, 1 innominates, 6 mandible, 7 maxillae, 3 metatarsals, 5 phalanges, 1 premaxilla, 3 radii, 1 sacrum, 1 scapula, 1 skull, 1 talus, 1 tibia, 3 ulna, 2 upper incisors

Sylvilagus sp.
Cottontail rabbits
Materials: 1 astragalus, 5 calcanei, 1 cuneiform, 3 femora, 6 humeri, 7 innominates, 3 lumbar vertebrae, 5 mandibles, 1 maxilla, 5 metacarpals, 8 metatarsals, 3 naviculars, 2 phalanges, 1 radius, 3 scapula, 2 skulls, 1 tarsal, 9 tibiae, 3 ulnae, 3 upper incisors, 1 vertebra.

Order Rodentia

Rodents
Family Sciuridae
Squirrels and allies

Sciuridae
Materials: 1 mandible, 1 maxilla

Spermophilus variegatus
Rock squirrel
Materials: 1 tibia

Family Cricetidae
New World rats and mice

cf. *Peromyscus* sp.
White-footed mice
Materials: 4 femora, 2 humeri, 2 innominates, 4 mandibles, 1 maxilla, 1 scapula, 1 skull, 2 tibiae

Neotoma sp.
Wood rats
Materials: 1 femur, 3 humeri, 1 lower incisor, 2 mandibles, 1 tibia

Family Geomyidae
Pocket gophers

Thomomys bottae
Botta's pocket gopher
Materials: 1 calcaneum, 2 innominates, 1 maxilla, 1 radius, 1 skull

cf. *Thomomys bottae*
Materials: 2 sacral vertebrae, 1 skull

Family Heteromyidae

Dipodomys ordi
Ord's kangaroo rat
Materials: 1 calcaneum, 8 femora, 1 humerus, 2 innominates, 2 lower incisors, 2 mandibles, 3 metatarsals, 1 sacrum, 10 tibiae, 1 upper incisor

cf. *Dipodomys ordi*
Materials: 1 mandible

Dipodomys sp.
Materials: 1 mandible, 2 tibiae, 1 ulna

Order Squamata

Family Iguanidae
Iguanids

Squamata
Materials: 2 mandibles, 1 skull, 1 unidentifiable

Phrynosoma sp.
Horned lizards

Materials: 3 femora, 1 humerus, 2 innominates, 2 mandibles, 4 sacral vertebrae, 5 scales, 1 scapula, 3 skulls, 1 tibia, 14 vertebrae

DISCUSSION

The most abundant taxon recovered from the different sites was *Sylvilagus* sp., which comprises 31.06% of the taxa that were identifiable to the genus or species level (cf. designations were included in the totals). Following *Sylvilagus* in abundance are *Lepus* sp. (22.55%), *Phrynosoma* sp. (15.74%), *Dipodomys ordi* (13.62%), *Peromyscus* sp. (7.23%), *Thomomys bottae* (3.83%) and *Neotoma* sp. (3.40%). These seven genera comprise 97.43% of the assemblage that were identifiable to genus level or better. The small mammal category represents the largest taxonomic category in the total assemblage with 6.73%.

One small mammal fragment from Site FB12219 displayed evidence (cut marks) of having been worked. The other cultural modification exhibited on some of the faunal remains was evidence of burning. Of the 1,317 bones, 547 (41.53%) were burned. Of the 51 *Lepus* sp. bones, 43.14% were burned, 17.81% of the 73 *Sylvilagus* sp. remains had evidence of burning, 23.08% of the 39 medium mammal remains and 5.95% of the 84 small mammal remains were burned. The assumption is that if burning is present, then this is interpreted as evidence that the animal was utilized for food and had been roasted (Hamblin et al. 1978: 226).

Table I1 lists the total number of identified specimens in all taxonomic categories recovered from the 33 sites. Nine mammalian taxa and one reptilian taxa were identified to genus level or better. Table I2 list in rank order the number of taxa that could be identified at the generic or specific level. One method of assessing relative importance of animals in the prehistoric economy is to look at rank-order abundance information. Table I3 provides a list of each catalog and/or extension analytical unit.

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Table I1. NISP Totals.

	Total	Percent
Avian (eggshell)	1	0.08
cf. Artiodactyl	1	0.08
cf. *Dipodomys ordi*	1	0.08
cf. *Peromyscus* sp.	1	0.08
cf. *Thomomys bottae*	3	0.23
Dipodomys ordi	31	2.35
Dipodomys sp.	4	0.30
Leporidae	18	1.37
Lepus sp.	51	3.87
Medium bird	1	0.08
Medium mammal	39	2.96
Microtus sp.	2	0.15
Neotoma sp.	8	0.61
Odocoileus hemionus	1	0.08
Peromyscus sp.	16	1.21
Phrynosoma sp.	37	2.80
Sciuridae	2	0.15
Small bird	1	0.08
Small mammal	84	6.73
Sperm ophilus variegatus	1	0.08
Squamata	4	0.30
Sylvilagus sp.	73	5.54
Thomomys bottae	6	0.46
Unidentifiable	931	70.69
Total	1,317	100.00

Table I2. NISP Totals and Ranks: Genus or Better Identification*

	Total	**Rank**
Dipodomys ordi	32	4
Dipodomys sp.	4	8
Lepus sp.	51	2
Microtus sp.	2	9
Neotoma sp.	8	7
Odocoileus hemionus	1	10
Peromyscus sp.	17	5
Phrynosoma sp.	37	3
Spermophilus variegatus	1	10
Sylvilagus sp.	73	1
Thomomys bottae	9	6
Total	235	

* *cf. collapsed with specific identifications*

Table I3. Faunal Catalog and Analysis.

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
6741	G1160	U	Unidentified	Small mammal	Shaft fragment	3	–	1
6741	G1160	U	Unidentified	Unidentified	Fragment	4	x (all)	2
6741	G1160	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1161	U	Unidentified	Unidentified		1	–	–
6741	G1166	U	Unidentified	Unidentified		1	x	1
6741	G1167	U	Unidentified	Unidentified		1	–	–
6741	G1212	U	Unidentified	Unidentified	Fragment	2	x (all)	1
6741	G1215	U	Unidentified	Unidentified		1	–	–
6741	G1219	A	Mandible	*Lepus* sp.	Fragment	1	–	1
6741	G1219	U	Scapula	*Sylvilagus* sp.	Fragment	1	–	2
6741	G1219	R	Humerus	*Lepus* sp.	Distal end	1	–	3
6741	G1347	U	Unidentified	Unidentified	Fragment	1	x	1
6741	G1348	U	Phalange	*Sylvilagus* sp.	Complete	1	–	1
6741	G1348	U	Unidentified	Unidentified	Fragment	3	–	–
6741	G1349	R	Maxilla	*Lepus* sp.	Fragment	1	–	1
6741	G1349	A	Skull	Unidentified	Fragment	3	–	2
6741	G1350	U	Unidentified	Unidentified		1	–	–
6741	G1355	U	Unidentified	Unidentified		1	–	–
6741	G1505	U	Unidentified	Unidentified	Fragments	1	x (all)	–
6741	G1730	U	Unidentified	Medium mammal	Joinable	3	–	1
6741	G1732	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1746	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1751	U	Unidentified	Unidentified	Fragments	5	–	–
6741	G1753	U	Unidentified	Unidentified	Fragment	4	–	–
6741	G1753	R	Calcaneum	*Sylvilagus* sp.	Complete	1	–	1
6741	G1755	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1755	U	Unidentified	Unidentified	Fragment	4	x (all)	1
6741	G1757	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1759	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1774	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1774	U	Unidentified	Unidentified	Fragment	3	x (all)	1
6741	G1796	R	Femur	*Neotoma* sp.	Distal end	1	x (all)	1
6741	G1796	U	Unidentified	Unidentified	Fragment	1	x (all)	2
6741	G1797	U	Unidentified	Unidentified	Fragment	3	–	–
6741	G1797	R	Ulna	*Sylvilagus* sp.	Proximal end	1	–	1

[Key to "Side" column not provided.–Ed.]

(Continued on next page.)

Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
6741	G1801	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1803	U	Eggshell	Aves	Fragment	1	–	–
6741	G1804	U	Unidentified	Unidentified	Fragment	11	–	–
6741	G1804	L	Talus	*Lepus* sp.	Complete	1	–	1
6741	G1804	L	Calcaneum	*Lepus* sp.	Joinable	2	–	2
6741	G1804	U	Unidentified	Unidentified	Fragment	5	x (all)	3
6741	G1805	U	Unidentified	Unidentified	Fragment	1	x (all)	1
6741	G1820	U	Unidentified	Unidentified	Fragment	2	–	–
6741	G1820	L	Humerus	*Neotoma* sp.	Epiphysis	1	–	1
6741	G1820	R	Cervical vertebra	Small mammal	Fragment	1	–	2
6741	G1820	R	Mandible	Sciuridae	Fragment	1	–	3
6741	G1820	R	Maxilla	Sciuridae	Fragment	1	–	4
6741	G1821	U	Unidentified	Unidentified	Fragments	2	x (all)	1
6741	G1823	U	Unidentified	Unidentified	Fragment	1	x (all)	1
6741	G1825	U	Unidentified	Unidentified	Fragment	1	x (all)	1
6741	G1826	U	Unidentified	Unidentified	Fragment	1	–	–
6741	G1857	U	Unidentified	Unidentified	Fragment	1	–	–
7483	G139	U	Unidentified	Unidentified	Fragment	2	–	–
7483	G175	U	Unidentified	Unidentified	Fragment	2	–	–
7483	G196	U	Unidentified	Unidentified		1	–	–
7483	G203	U	Unidentified	Unidentified		1	–	–
7483	G241	A	Maxilla	*Lepus* sp.	Fragment-palatine	1	–	1
7483	G241	A	Maxilla	*Lepus* sp.	Joinable-palatine	2	–	2
7483	G309	U	Unidentified	Unidentified		1	x	1
7483	G311	U	Unidentified	Small bird		1	–	1
7483	G351	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7483	G450	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7483	G480	U	Unidentified	Unidentified	Fragment	1	–	–
7510	G729	R	Sacral vertebra	Medium mammal	Fragment	1	–	1
7517	G183	U	Unidentified	Unidentified		1	–	–
7520	G482	U	Unidentified	Unidentified	Fragments	2	x (all)	1
7547	G388	L	Calcaneum	*Sylvilagus* sp.		1	x	1
7547	G388	U	Unidentified	Unidentified	Fragment	1	x	2
7547	G474	U	Unidentified	Unidentified	Fragment	1	x (all)	1

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Table I3. Faunal Catalog and Analysis.

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
7547	G475	L	Metatarsal	*Lepus* sp.	Proximal end/shaft #4	1	x (all)	1
7547	G505	U	Unidentified	Unidentified	Fragments	3	–	–
7547	G505	U	Unidentified	Small mammal	Shaft fragment	1	–	1
7547	G506	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7547	G508	U	Unidentified	Unidentified	Fragment	1	–	–
7547	G512	U	Unidentified	Unidentified	Fragment	4	–	–
7547	G514	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7547	G518	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7547	G521	U	Unidentified	Unidentified	Fragment	1	–	–
7547	G521	U	Phalanx	Medium mammal	Complete	1	x (all)	1
7547	G521	L	Tibia	*Dipodomys* sp.	Shaft fragment	1	–	2
7547	G521	U	Unidentified	Unidentified	Fragment	17	x (all)	3
7569	G48	U	Unidentified	Unidentified	Fragment	3	x (all)	1
7569	G49	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7569	G60	U	Unidentified	Unidentified	Fragments	1	x (all)	1
7580	G172	U	Unidentified	Unidentified	Fragments	3	x (all)	1
7580	G174	U	Unidentified	Unidentified	Fragment	1	x (all)	1
7580	G177	L	Metatarsal	*Lepus* sp.	Proximal end/shaft	1	x (all)	1
7580	G177	U	Unidentified	Unidentified	Fragment	3	x (all)	2
10411	G114	U	Unidentified	Unidentified	Fragments	9	–	–
10411	G114	R	Radius	*Lepus* sp.	Distal end	1	–	1
10411	G114	A	Cervical vertebra	Small mammal	Complete	5	–	2
10411	G114	A	Skull	*Sylvilagus* sp.	Occipital	1	–	3
10411	G114	U	Tooth	Medium mammal	Fragment	1	–	4
10411	G114	A	Sacral vertebra	Small mammal	Complete	1	–	5
10411	G115	U	Metapodial	cf. Artiodactyl	Fragment	1	–	1
10411	G118	U	Unidentified	Unidentified	Fragment	6	–	–
10411	G118	A	Mandible	Small mammal		1	–	1
10411	G118	L	Femur	*Sylvilagus* sp.	Head	1	–	2
10411	G118	A	Cervical vertebra	Small mammal		1	–	3
10411	G118	A	Lumbar vertebra	*Sylvilagus* sp.	1	–	4	
10411	G118	A	Sacral vertebra	Small mammal		1	–	5
10411	G118	R	Humerus	*Sylvilagus* sp.	Distal end & shaft	1	x	6
10411	G118	R	Upper incisor	*Dipodomys ordi*		1	–	7
10411	G118	U	Unidentified	Unidentified	Fragment	2	x (all)	8
10411	G118	U	Unidentified	Unidentified	Fragment	1	–	–

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10411	G118	U	Phalanx	Small mammal	Complete	1	–	8
10411	G118	U	Unidentified	Unidentified	Fragment	1	x (all)	9
10411	G119	U	Unidentified	Unidentified	Fragment	9	–	–
10411	G119	U	Upper incisor	*Lepus* sp.	Fragment	1	–	1
10411	G123	U	Unidentified	Unidentified	Fragment	9	–	–
10411	G123	U	Lower incisor	*Dipodomys ordi*		1	–	1
10411	G123	L	Innominate	*Sylvilagus* sp.	Acetabulum	1	–	2
10411	G123	U	Metatarsal	*Dipodomys ordi*	Proximal end & shaft	1	–	3
10411	G123	A	Skull	Unidentified	Fragment	2	–	4
10411	G123	U	Humerus	*Lepus* sp.	Distal fragment	2	–	5
10411	G123	U	Metatarsal	*Dipodomys ordi*	Distal end & shaft	1	–	6
10411	G123	U	Rib	Small mammal		1	–	7
10411	G124	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G124	A	Sacral vertebra	Small mammal	Complete	1	–	1
10411	G124	U	Tarsal	*Sylvilagus* sp.		1	x	3
10411	G124	A	Thoracic vertebra	Small mammal	Complete	1	–	2
10411	G124	R	Tibia	*Spermophilus variegatus*	Distal	1	x	4
10411	G124	A	Mandible	*Lepus* sp.		1	x	5
10411	G124	U	Unidentified	Unidentified	Fragment	4	x (all)	6
10411	G132	R	Mandible	cf. *Dipodomys ordi*		1	–	1
10411	G133	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G133	L	Tibia	*Sylvilagus* sp.	Distal fragment	1	–	1
10411	G133	A	Sacral vertebra	Small mammal		1	–	2
10411	G134	U	Unidentified	Unidentified	Fragment	5	–	–
10411	G134	U	Unidentified	Small mammal	Fragment	1	–	1
10411	G134	R	Femur	cf. *Peromyscus* sp.	Proximal end & shaft	1	–	2
10411	G134	L	Calcaneum	*Dipodomys ordi*		1	–	3
10411	G134	L	Innominate	*Dipodomys ordi*	Acetabulum	2	–	4
10411	G134	A	Sacrum	*Dipodomys ordi*		1	–	5
10411	G134	U	Lower incisor	*Dipodomys ordi*		1	–	6
10411	G134	R	Mandible	*Dipodomys ordi*	Fragment	1	–	7
10411	G134	L	Tibia	*Dipodomys ordi*	Complete	1	–	8
10411	G134	L	Femur	*Dipodomys ordi*	Complete	1	–	9
10411	G134	U	Metatarsal	*Dipodomys ordi*		1	–	10

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10411	G134	R	Innominate	*Sylvilagus* sp.	Ischium	1	x	11
10411	G134	U	Unidentified	Unidentified	Fragment	2	x (all)	12
10411	G134	U	Skull	Unidentified	Fragment	3	–	13
10411	G135	U	Unidentified	Unidentified	Fragment	2	–	–
10411	G136	U	Unidentified	Unidentified	Fragment	2	–	–
10411	G136	U	Incisor	Small mammal	Fragment	1	–	1
10411	G139	L	Humerus	*Lepus* sp.	Distal end	1	x	1
10411	G139	U	Unidentified	Unidentified	Fragment	2	x (all)	2
10411	G142	R	Mandible	*Lepus* sp.	Fragment	1	–	1
10411	G144	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G144	L	Humerus	*Neotoma* sp.	Distal end	1	–	1
10411	G144	L	Humerus	*Dipodomys ordi*	Complete	1	–	2
10411	G144	U	Lower incisor	*Neotoma* sp.		1	–	3
10411	G144	R	Humerus	*Neotoma* sp.	Distal end	1	–	4
10411	G144	L	Mandible	*Neotoma* sp.	Fragment	1	–	5
10411	G150	U	Unidentified	Unidentified		1	–	–
10411	G150	R	Femur	*Dipodomys ordi*	Proximal end & shaft	1	–	1
10411	G151	U	Unidentified	Unidentified		1	–	–
10411	G152	U	Metatarsal	*Lepus* sp.	Distal end & shaft	1	–	1
10411	G153	U	Tibia	Small mammal	Proximal fragment	1	–	1
10411	G154	R	Tibia	*Lepus* sp.	Proximal end	1	–	1
10411	G155	U	Unidentified	Unidentified		1	–	–
10411	G156	U	Unidentified	Unidentified	Fragment	3	–	–
10411	G156	A	Thoracic vertebra	Small mammal		3	–	1
10411	G156	A	Lumbar vertebra	*Sylvilagus* sp.		1	–	2
10411	G158	U	Unidentified	Small mammal		2	–	1
10411	G159	R	Innominate	*Sylvilagus* sp.	Acetabulum	1	–	1
10411	G174	U	Unidentified	Unidentified	Fragment	6	–	–
10411	G174	R	Mandible	*Neotoma* sp.	Fragment	1	–	1
10411	G176	R	Skull	Squamata	Fragment	1	–	1
10411	G177	R	Scale	*Phrynosoma* sp.	Fragments	1	–	–
10411	G177	U	Tooth	Leporid	Fragment	1	–	1
10411	G179	R	Mandible	Squamata	Fragment	1	–	1
10411	G180	U	Unidentified	Unidentified	Fragments	12	–	–

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10411	G180	R	Ulna	*Dipodomys* sp.	Shaft fragment	1	–	1
10411	G180	L	Tibia	*Phrynosoma* sp.	Shaft fragment	1	–	2
10411	G180	R	Femur	*Phrynosoma* sp.	Shaft fragment	1	–	3
10411	G180	L	Scapula	*Phrynosoma* sp.	Fragment	1	–	4
10411	G180	R	Sacral vertebra	*Phrynosoma* sp.	Fragments	2	–	5
10411	G180	U	Teeth	Leporid	Fragments	2	–	6
10411	G182	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G182	L	Tibia	*Peromyscus* sp.	Shaft fragment	1	–	1
10411	G182	R	Tibia	*Peromyscus* sp.	Shaft fragment	1	–	2
10411	G182	R	Femur	*Peromyscus* sp.	Complete	1	–	3
10411	G182	L	Femur	*Peromyscus* sp.	Proximal end/shaft	1	–	4
10411	G182	R	Humerus	*Peromyscus* sp.	Distal end/shaft	1	–	5
10411	G182	L	Humerus	*Peromyscus* sp.	Distal end/shaft	1	–	6
10411	G182	L	Innominate	*Peromyscus* sp.	Fragment	1	–	7
10411	G182	R	Innominate	*Peromyscus* sp.	Fragment	1	–	8
10411	G182	L	Mandible	*Peromyscus* sp.	Fragment	1	–	9
10411	G182	L	Mandible	*Peromyscus* sp.	Fragment	1	–	10
10411	G182	L	Scapula	*Peromyscus* sp.	Fragment	1	–	11
10411	G182	R	Vertebra	Medium mammal	Epiphysis	1	–	12
10411	G182	R	Skull	*Peromyscus* sp.	Basioccipital	1	–	13
10411	G182	R	Sacrum	Small mammal	Fragment	1	–	14
10411	G182	L	Mandible	*Peromyscus* sp.	Fragment	1	–	15
10411	G182	R	Mandible	*Peromyscus* sp.	Fragment	1	–	16
10411	G182	R	Skull	Unidentified	Fragments	7	–	17
10411	G182	R	Maxilla	*Peromyscus* sp.	Fragment	1	–	18
10411	G183	U	Unidentified	Unidentified	Fragments	10	–	–
10411	G183	R	Calcaneum	*Lepus* sp.	Fragment	1	–	1
10411	G183	R	Vertebra	*Phrynosoma* sp.	Complete	1	–	2
10411	G183	U	Skull	Leporid	Fragment	1	x (all)	3
10411	G183	L	Cuneiform	*Lepus* sp.	Fragment	1	–	4
10411	G183	R	Ulna	*Lepus* sp.	Fragment	1	–	5
10411	G183	R	Skull	Small mammal	Fragment	2	–	6
10411	G183	U	Unidentified	Unidentified	Fragments	5	x (all)	7
;10411	G184	U	Unidentified	Unidentified	Fragment	3	–	–

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10411	G184	U	Teeth	Leporid	Fragment	3	–	1
10411	G184	U	Unidentified	Small mammal	Shaft fragment	1	–	2
10411	G184	L	Innominate	*Phrynosoma* sp.	Fragment	1	–	3
10411	G184	R	Humerus	*Phrynosoma* sp.	Complete	1	–	4
10411	G184	R	Scale	*Phrynosoma* sp.	Fragment	3	–	5
10411	G184	R	Mandible	*Phrynosoma* sp.	Fragment	1	–	6
10411	G184	R	Skull	*Phrynosoma* sp.	Basioccipital	1	–	7
10411	G184	R	Vertebra	*Phrynosoma* sp.	Fragment	13	–	8
10411	G184	U	Teeth	Leporid	Fragment	1	x (all)	9
10411	G184	U	Unidentified	Unidentified	Fragment	3	x (all)	10
10411	G185	U	Unidentified	Unidentified	Fragment	2	–	–
10411	G185	R	Sacral vertebra	*Phrynosoma* sp.	Fragment	2	–	1
10411	G185	R	Tibia	*Phrynosoma* sp.	Shaft fragment	1	–	2
10411	G185	U	Unidentified	Squamata	Fragment	1	–	3
10411	G185	L	Innominate	*Phrynosoma* sp.	Fragment	1	–	4
10411	G185	L	Femur	*Phrynosoma* sp.	Fragment	1	–	5
10411	G187	U	Unidentified	Unidentified	Fragment	1	x (all)	1
10411	G188	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G188	U	Phalanx	Medium mammal	Complete	1	–	1
10411	G188	L	Calcaneum	*Sylvilagus* sp.	Fragment	1	x (all)	2
10411	G188	U	Unidentified	Unidentified	Fragment	1	x (all)	3
10411	G191	U	Unidentified	Unidentified	Fragment	2	–	–
10411	G192	U	Unidentified	Unidentified	Fragments	1	x (all)	1
10411	G194	U	Unidentified	Unidentified	Fragment	1	x (all)	1
10411	G195	R	Innominate	*Sylvilagus* sp.	Joinable	1	x (all)	1
10411	G195	U	Unidentified	Unidentified	Fragment	3	x (all)	2
10411	G196	U	Unidentified	Unidentified	Fragment	1	–	–
10411	G198	R	Scale	*Phrynosoma* sp.	Fragment	1	–	1
10411	G200	R	Vertebra	Medium mammal	Centrum	1	–	1
10411	G200	R	Sacrum	*Lepus* sp.	Fragment	1	–	2
10411	G201	R	Sacral vertebra	Small mammal	Fragment	1	–	1
10411	G202	U	Unidentified	Unidentified	Fragment	5	–	–
10411	G202	U	Tooth	Leporid	Fragment	1	–	1
10411	G202	R	Femur	*Phrynosoma* sp.	Shaft fragment	1	–	2

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10411	G202	R	Skull	*Phrynosoma* sp.	Fragment	1	–	3
10411	G202	U	Rib	Small mammal	Proximal end/shaft	1	–	4
10411	G204	U	Unidentified	Unidentified	Fragment	4	–	–
10411	G204	L	Mandible	*Sylvilagus* sp.	Fragment	2	–	1
10411	G204	R	Femur	*Peromyscus* sp.	Proximal end/shaft	1	–	2
10411	G204	R	Sacral vertebra	Small mammal	Fragment	1	–	3
10411	G204	R	Skull	Leporid	Fragment	1	–	4
10411	G206	R	Sacral vertebra	Small mammal	Fragment	1	–	1
10411	G207	L	Mandible	Squamata	Fragment	1	–	1
10411	G207	L	Tibia	Small mammal	Proximal end/shaft	1	–	2
10411	G209	R	Tibia	Dipodomys sp.	Shaft	1	–	1
10411	G243	U	Unidentified	Unidentified	Fragment	2	–	–
10411	G246	U	Unidentified	Unidentified	Fragment	1	x (all)	1
10413	G19	U	Tibia	*Sylvilagus* sp.	Shaft joinable	2	–	1
10416	G20	U	Unidentified	Unidentified	Fragments	6	–	–
10416	G21	R	Mandible	*Dipodomys* sp.	Fragment	1	–	1
10416	G22	R	Skull	*Phrynosoma* sp.	Basioccipital	1	–	1
10416	G25	R	Humerus	*Microtos* sp.	Distal end/shaft	1	–	1
10416	G25	R	Mandible	*Phrynosoma* sp.	Fragment	1	–	2
10416	G25	U	Unidentified	Unidentified	Fragment	1	x (all)	3
10417	G45	U	Unidentified	Unidentified		1	x	1
10417	G48	R	Maxilla	*Sylvilagus* sp.	Fragment	1	–	1
10417	G48	U	Upper incisor	*Sylvilagus* sp.		2	–	2
10417	G48	R	Maxilla	*Lepus* sp.		1	–	3
10417	G48	A	Maxilla	*Thomomys bottae*	Rostrum	1	–	4
10417	G48	A	Skull	*Thomomys bottae*	Foramen magnum	1	–	5
10417	G48	U	Calcaneum	*Thomomys bottae*		1	–	6
10417	G48	A	Sacral vertebra	cf. *Thomomys bottae*		2	–	7
10417	G48	A	Skull	cf. *Thomomys bottae*	Bullae	1	–	8
10417	G48	U	Unidentified	Small mammal	Fragment	1	–	9
10417	G48	A	Skull	Small mammal	Fragment	8	–	10
10417	G48	U	Lower incisor	Medium mammal		1	–	11
10417	G48	U	Teeth	Medium mammal	Fragments	7	–	12
10417	G48	L	Innominate	*Thomomys bottae*	Illum fragment	1	–	13

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
10417	G48	R	Innominate	*Thomomys bottae*	Illum fragment	1	–	14
10417	G48	R	Radius	*Thomomys bottae*	Complete	1	–	15
10417	G96	U	Unidentified	Unidentified		1	x	1
11299	G32	U	Unidentified	Unidentified		1	x	1
11299	G41	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12017	G8	L	Tibia	*Sylvilagus* sp.	Shaft fragment	1	–	1
12017	G8	L	Ulna	*Lepus* sp.	Proximal fragment	1	–	2
12017	G8	U	Unidentified	Unidentified	Fragments	5	x (all)	3
12069	G119	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12069	G141	U	Innominate	Medium mammal	Acetabulum	1	x (all)	1
12069	G144	U	Unidentified	Unidentified	Fragment	2	–	–
12069	G144	L	Skull	*Sylvilagus* sp.	Temporal	1	–	1
12069	G144	R	Innominate	Small mammal	Fragment	1	–	2
12069	G148	U	Unidentified	Unidentified	Fragments	12	x (all)	1
12069	G152	U	Unidentified	Unidentified	Fragment	3	x (all)	1
12069	G155	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12069	G161	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12069	G162	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12069	G163	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12072	G44	U	Skull	Unidentified	Fragments	8	–	1
12072	G44	U	Unidentified	Small mammal	Fragments	1	–	2
12072	G57	U	Unidentified	Unidentified	Fragments	2	x (all)	1
12072	G58	U	Unidentified	Unidentified	Fragment	1	–	–
12072	G58	R	Tibia	*Sylvilagus* sp.	Distal end/shaft	1	–	1
12072	G58	L	Metatarsal	*Sylvilagus* sp.	Proximal end/shaft #2	1	–	2
12097	G17	R	Vertebra	Medium mammal	Fragment	1	x (all)	1
12097	G18	U	Unidentified	Unidentified	Fragment	2	–	–
12097	G19	U	Unidentified	Unidentified	Fragment	1	–	–
12097	G20	U	Unidentified	Unidentified	Fragment	1	–	–
12100	G114	U	Unidentified	Unidentified	Fragment	8	x (all)	1
12100	G124	U	Unidentified	Unidentified	Fragment	2	–	–
12100	G126	U	Unidentified	Unidentified		2	–	–
12100	G143	U	Unidentified	Unidentified	Fragment	4	–	–
12100	G143	U	Calcaneum	*Sylvilagus* sp.		1	–	1

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12100	G150	U	Unidentified	Medium mammal	Fragment	1	–	1
12100	G150	U	Unidentified	Unidentified	Fragment	1	x	2
12100	G152	U	Metatarsal	*Sylvilagus* sp.	Joinable	2	–	1
12100	G155	U	Unidentified	Unidentified	Fragment	24	x (all)	2
12100	G155	U	Metacarpal	*Sylvilagus* sp.	Proximal end & shaft	1	x	1
12100	G155	U	Unidentified	Unidentified	Fragment	8	x (all)	2
12100	G157	U	Unidentified	Unidentified	Fragment	2	–	–
12100	G157	U	Unidentified	Unidentified	Fragment	1	x (all)	10
12100	G157	U	Unidentified	Unidentified	Fragment	16	–	–
12100	G157	L	Navicular	*Sylvilagus* sp.	Complete	1	–	1
12100	G157	L	Ulna	*Sylvilagus* sp.	Proximal	1	–	2
12100	G157	U	Metacarpal	*Sylvilagus* sp.		1	–	3
12100	G157	R	Mandible	*Dipodomys ordi*		1	–	4
12100	G157	R	Tibia	*Dipodomys ordi*	Proximal end	1	–	5
12100	G157	U	Incisor	Medium mammal	Fragment	2	–	6
12100	G157	U	Maxilla	Small mammal	Fragment	2	–	7
12100	G157	U	Metatarsal	*Sylvilagus* sp.		3	–	8
12100	G157	R	Radius	*Sylvilagus* sp.	Proximal end & shaft	1	–	9
12100	G158	U	Unidentified	Unidentified	Fragment	1	–	–
12100	G158	U	Unidentified	Unidentified	Fragment	1	–	–
12100	G158	L	Humerus	*Sylvilagus* sp.	Distal end	1	–	1
12100	G158	R	Ulna	*Sylvilagus* sp.	Proximal end	1	–	2
12100	G158	U	Phalange	*Sylvilagus* sp.	Distal	1	–	3
12100	G158	A	Skull	Unidentified	Fragment	3	–	4
12100	G158	U	Metatarsal	*Sylvilagus* sp.	Proximal end & shaft	1	–	5
12100	G158	U	Mandible	*Lepus* sp.	Fragment	1	–	6
12100	G159	U	Phalange	Small mammal	Complete	1	–	1
12100	G159	U	Teeth	Medium mammal	Fragment	5	–	2
12100	G159	U	Navicular	*Sylvilagus* sp.		1	–	3
12100	G159	U	Unidentified	Medium mammal	Fragment	2	–	4
12100	G167	U	Unidentified	Small mammal		1	x	1
12100	G168	L	Tibia	*Dipodomys ordi*	Distal end	1	–	2
12100	G168	U	Unidentified	Unidentified		2	–	–
12100	G168	U	Upper incisor	*Sylvilagus* sp.	Fragment	1	–	1

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12100	G169	U	Scapula	Small mammal	Acromium fragment	1	–	1
12100	G170	U	Unidentified	Small mammal	Fragment	2	x (all)	1
12100	G172	U	Unidentified	Unidentified	Fragment	5	–	–
12100	G172	R	Humerus	*Sylvilagus* sp.	Distal end	1	–	1
12100	G172	U	Metacarpal	*Sylvilagus* sp.		1	–	2
12100	G172	R	Ulna	*Lepus* sp.	Distal epiphysis	1	–	3
12100	G172	L	Humerus	*Sylvilagus* sp.	Distal end	1	–	4
12100	G172	R	Innominate	*Sylvilagus* sp.	Acetabulum	1	–	5
12100	G172	L	Tibia	*Dipodomys ordi*	Proximal end	1	–	6
12100	G172	R	Tibia	*Sylvilagus* sp.	Proximal epiphysis	1	–	7
12100	G173	L	Tibia	*Dipodomys ordi*	Proximal end	2	–	1
12100	G173	R	Tibia	*Dipodomys ordi*	Shaft fragment	1	–	2
12100	G174	U	Unidentified	Unidentified		2	x (all)	1
12100	G179	U	Calcaneum	*Lepus* sp.	Fragment	1	x	1
12100	G181	U	Unidentified	Unidentified	Fragment	6	–	–
12100	G181	R	Femur	*Dipodomys ordi*	Head	1	–	1
12100	G181	R	Tibia	*Dipodomys ordi*		1	–	2
12100	G181	A	Lumbar vertebra	*Sylvilagus* sp.		1	–	3
12100	G181	A	Caudal vertebra	Small mammal		1	–	4
12100	G181	A	Sacral vertebra	Small mammal		1	–	5
12100	G181	L	Tibia	*Dipodomys ordi*		1	–	6
12100	G181	L	Femur	*Dipodomys ordi*	Head	2	–	7
12100	G181	R	Femur	*Dipodomys ordi*	Distal epiphysis	2	–	8
12100	G183	U	Unidentified	Unidentified	Fragment	18	–	–
12100	G183	R	Mandible	Small mammal	Fragment	1	–	1
12100	G183	L	Mandible	Small mammal	Fragment	1	–	2
12100	G183	U	Teeth	Small mammal	Fragment	4	–	3
12100	G183	A	Skull	Small mammal	Fragment	8	–	4
12100	G183	L	Mandible	*Sylvilagus* sp.	Fragment	1	–	5
12100	G183	R	Innominate	*Sylvilagus* sp.	Acetabulum	1	–	6
12100	G183	U	Metacarpal	*Sylvilagus* sp.	Proximal end & shaft	1	–	7
12100	G183	R	Scapula	*Sylvilagus* sp.	Acromium process	1	–	8
12100	G183	U	Phalange	Small mammal	Complete	4	–	9
12100	G183	R	Tibia	*Dipodomys ordi*	Proximal end	1	–	10

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12100	G183	R	Astragalus	*Sylvilagus* sp.		1	–	11
12100	G183	L	Femur	*Dipodomys ordi*	Head	1	–	12
12100	G183	R	Tibia	*Neotoma* sp.	Distal end	1	–	13
12100	G183	A	Vertebra	Small mammal		3	–	14
12100	G183	U	Radius	*Lepus* sp.	Fragment	1	–	15
12100	G183	L	Humerus	*Lepus* sp.	Distal epiphysis	1	–	16
12100	G183	R	Calcaneum	*Sylvilagus* sp.	Complete	1	–	17
12100	G183	R	Navicular	*Sylvilagus* sp.	Complete	1	–	18
12100	G183	U	Metatarsal	*Sylvilagus* sp.		1	–	19
12100	G183	A	Vertebra	*Sylvilagus* sp.	Epiphysis	1	–	20
12100	G183	L	Humerus	*Sylvilagus* sp.		1	–	21
12100	G183	U	Cuneiform	*Sylvilagus* sp.	Complete	1	–	22
12100	G183	R	Tibia	*Sylvilagus* sp.	Distal end	1	–	23
12100	G185	U	Unidentified	Unidentified		1	–	–
12100	G186	U	Unidentified	Unidentified	Fragment	4	–	–
12100	G186	U	Humerus	*Sylvilagus* sp.	Distal	1	–	1
12100	G201	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12100	G206	U	Unidentified	Unidentified	Fragment	2	–	–
12100	G206	U	Unidentified	Unidentified	Fragment	2	x (all)	1
12100	G237	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12100	G262	U	Unidentified	Unidentified	Fragment	2	–	–
12100	G262	U	Unidentified	Unidentified	Fragment	2	x (all)	1
12100	G270	U	Unidentified	Unidentified	Fragment	2	x (all)	1
12100	G276	U	Unidentified	Unidentified	Fragment	1	–	–
12100	G276	U	Phalanx	Medium mammal	Complete	1	x (all)	1
12100	G276	U	Unidentified	Unidentified	Fragment	1	x (all)	2
12100	G294	U	Unidentified	Unidentified	Fragment	5	x (all)	1
12100	G295	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12100	G299	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12100	G332	U	Phalanx	Medium mammal	Complete	1	x (all)	1
12100	G332	U	Unidentified	Unidentified	Fragments	4	x (all)	2
12102	G58	U	Unidentified	Unidentified		1	–	–
12102	G95	U	Unidentified	Unidentified		1	x	1
12102	G97	U	Unidentified	Unidentified		1	–	–

(Continued on next page.)

Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12102	G117	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12102	G157	U	Unidentified	Unidentified		2	–	–
12213	G4	U	Phalanx	Medium mammal	Distal end/shaft	2	x (all)	1
12213	G4	U	Unidentified	Unidentified	Fragments	2	x (all)	2
12216	G13	U	Metacarpal	*Sylvilagus* sp.	Distal end & shaft	1	–	1
12217	G23	U	Unidentified	Unidentified		1	–	–
12217	G43	U	Unidentified	Unidentified	Fragment	2	–	–
12217	G51	U	Unidentified	Unidentified	Fragment	3	–	–
12217	G51	U	Unidentified	Unidentified	Fragment	4	x (all)	1
12217	G52	U	Unidentified	Unidentified	Fragment	1	x	1
12219	G67	R	Mandible	*Sylvilagus* sp.	Fragment	1	x	1
12219	G98	U	Unidentified	Small mammal	Fragment-worked	1	x	1
12225	G4	U	Unidentified	Unidentified	Fragment	1	–	–
12225	G4	L	Mandible	*Sylvilagus* sp.	Fragment	1	–	1
12225	G4	R	Femur	*Sylvilagus* sp.	Shaft fragment	1	–	2
12225	G5	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12225	G12	U	Unidentified	Unidentified	Fragment	10	x (all)	1
12237	G17	U	Unidentified	Unidentified	Fragment	1	–	–
12237	G17	L	Mandible	*Lepus* sp.	Fragment	1	–	1
12237	G37	U	Tooth	Leporid	Fragments	3	–	1
12237	G37	U	Unidentified	Unidentified	Fragment	2	x (all)	2
12237	G40	U	Unidentified	Unidentified	Fragment	1	–	–
12237	G45	R	Mandible	*Lepus* sp.	Fragment	1	–	1
12237	G63	U	Unidentified	Unidentified	Fragment	1	–	–
12239	G115	L	Femur	*Sylvilagus* sp.	Proximal end (head)	1	x	1
12240	G11	U	Incisor	Small mammal		2	–	1
12240	G11	U	Upper incisor	*Lepus* sp.	Fragment	1	–	2
12240	G11	A	Maxilla	*Lepus* sp.	Fragment	2	x (all)	3
12240	G11	U	Tibia	*Sylvilagus* sp.	Proximal shaft fragment	1	x	4
12240	G11	U	Unidentified	Unidentified	Fragment	12	x (all)	5
12247	G106	L	Humerus	*Lepus* sp.	Proximal end	1	x	1
12247	G106	U	Unidentified	Unidentified	Fragment	2	x (all)	2
12254	G21	U	Unidentified	Small mammal	Fragment	1	x	1
12254	G21	R	Innominate	*Sylvilagus* sp.	Ileum	1	x	2

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12254	G22	U	Unidentified	Unidentified		1	–	–
12254	G23	U	Unidentified	Unidentified		1	–	–
12316	G32	U	Unidentified	Unidentified	Fragment	5	x (all)	1
12316	G33	U	Unidentified	Unidentified	Fragment	1	–	–
12316	G34	U	Unidentified	Unidentified	Fragment	14	–	–
12316	G34	U	Unidentified	Unidentified	Fragment	3	x (all)	1
12316	G35	U	Unidentified	Unidentified	Fragment	6	–	–
12316	G35	U	Unidentified	Unidentified	Fragment	11	x (all)	1
12316	G36	U	Unidentified	Unidentified	Fragment	14	–	–
12316	G36	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12316	G37	U	Unidentified	Unidentified	Fragments	4	x (all)	1
12316	G38	U	Unidentified	Unidentified	Fragment	2	–	–
12316	G40	U	Unidentified	Unidentified	Fragment	2	–	–
12316	G40	U	Unidentified	Unidentified	Fragment	2	x (all)	1
12316	G41	U	Unidentified	Unidentified	Fragment	3	–	–
12316	G42	U	Unidentified	Unidentified	Fragment	2	–	–
12316	G43	U	Unidentified	Unidentified	Fragment	2	–	–
12316	G44	U	Tooth	*Microtus* sp.	Molar	1	–	1
12316	G45	U	Unidentified	Unidentified	Fragment	2	–	–
12316	G46	U	Unidentified	Medium bird	Fragment	1	–	–
12316	G47	U	Unidentified	Unidentified	Fragment joinable	2	x (all)	1
12316	G50	U	Unidentified	Unidentified	Fragment	1	–	–
12316	G52	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12316	G53	U	Phalanx	Medium mammal	Complete	1	–	1
12316	G54	U	Unidentified	Unidentified	Fragments	44	–	–
12316	G54	U	Unidentified	Unidentified	Fragments	27	x (all)	1
12316	G56	U	Unidentified	Unidentified	Fragments	26	–	–
12316	G56	U	Phalanx	Medium mammal	Proximal end/shaft	2	–	1
12316	G56	U	Phalanx	Medium mammal	Distal end/shaft	1	–	2
12316	G56	L	Radius	*Lepus* sp.	Proximal end	1	x (all)	3
12316	G56	L	Calcaneum	Small mammal	Joinable	2	–	4
12316	G56	U	Unidentified	Unidentified	Fragments	65	x (all)	5
12316	G57	U	Unidentified	Unidentified	Fragments	12	–	–
12316	G57	L	Humerus	*Lepus* sp.	Distal end	1	x (all)	1

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12316	G57	U	Unidentified	Unidentified	Fragments	17	x (all)	2
12316	G71	U	Unidentified	Unidentified	Fragment	1	–	–
12316	G105	U	Unidentified	Unidentified	Fragment	3	–	–
12319	G5	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12330	G26	U	Unidentified	Unidentified	Fragments	12	x (all)	1
12330	G47	U	Unidentified	Unidentified	Fragment	6	x (all)	2
12330	G47	U	Unidentified	Unidentified	Fragment	2	–	–
12330	G110	U	Unidentified	Unidentified	Fragment	1	–	–
12330	G114	U	Unidentified	Unidentified	Fragments	1	–	–
12330	G117	U	Unidentified	Unidentified	Fragment	1	–	–
12330	G123	L	Tibia	*Sylvilagus* sp.	Distal shaft	1	x (all)	1
12330	G125	U	Unidentified	Medium mammal	Proximal end/shaft	1	x (all)	1
12330	G125	R	Innominate	*Lepus* sp.	Fragments	2	x (all)	2
12330	G125	U	Unidentified	Unidentified	Fragments	16	x (all)	3
12330	G128	U	Unidentified	Unidentified	Fragment	7	–	–
12330	G128	U	Teeth	Leporid	Fragment	3	x (all)	1
12330	G128	L	Premaxilla	*Lepus* sp.	Fragment	1	x (all)	2
12330	G128	R	Skull	*Lepus* sp.	Vomer	1	x (all)	3
12330	G128	L	Scapula	*Sylvilagus* sp.	Acetabulum	1	x (all)	4
12330	G128	L	Innominate	*Lepus* sp.	Ileum	1	x (all)	5
12330	G128	U	Metapodial	Medium mammal	Proximal end/shaft	1	x (all)	6
12330	G128	U	Unidentified	Unidentified	Fragment	44	x (all)	7
12330	G135	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12330	G144	L	Humerus	*Lepus* sp.	Epiphysis	1	x (all)	1
12330	G144	L	Scapula	*Lepus* sp.	Acetabulum	1	x (all)	2
12330	G144	L	Femur	*Lepus* sp.	Epiphysis	1	x (all)	3
12330	G144	U	Phalanx	*Lepus* sp.	1st	2	x (all)	4
12330	G144	U	Phalanx	*Lepus* sp.	2nd	2	x (all)	5
12330	G144	U	Unidentified	Unidentified	Fragments	25	x (all)	6
12330	G152	L	Naviculo cuboid	*Odocoileus hemionus*	Complete	1	–	1
12330	G153	R	Sacral vertebra	Small mammal	Fragment	1	–	1
12330	G155	U	Unidentified	Unidentified	Fragment	1	–	–
12330	G172	U	Unidentified	Unidentified	Fragment	1	–	–
12330	G172	U	Unidentified	Unidentified	Fragment	4	x (all)	1

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Table I3. Faunal Catalog and Analysis (continued).

FB Site Number	Cat #	Side	Element	Taxa	Landmark/Part	Bone Count	Burning	Ext.
12330	G180	U	Unidentified	Unidentified	Fragments	5	x (all)	1
12330	G201	U	Unidentified	Unidentified	Fragment	3	–	–
12330	G201	U	Unidentified	Unidentified	Fragment	6	x (all)	1
12330	G222	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12330	G223	U	Tooth	Leporid	Fragment	2	–	–
12331	G1	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12331	G13	U	Unidentified	Unidentified	Fragment	2	x (all)	1
12331	G19	U	Unidentified	Unidentified	Fragment	1	x (all)	1
12331	G22	U	Unidentified	Unidentified	Fragment	2	x (all)	1

Appendix J
Experimental Hearth Stone Research Procedures

by
Raymond Mauldin

Features containing hearth stones were common in the project area and the class made up a significant component of all features. Because detailed information on the costs and benefits associated with the addition of rock or caliche was lacking, a series of experiments was designed to learn about the potential uses of stone. The goal of these experiments was not to re-create, in any sense, the archaeological features. The goal was simply to learn about the addition of stone to features.

Four separate areas were of concern: (1) monitoring thermal advantage to the addition of stone, specifically caliche; (2) generating data that may provide information on reuse of features because size changes in the stone with reuse were suspected; (3) understanding the use of different rock types, as other rocks, specifically limestone, rhyolite, and quartzite, were used in archaeological cases; and (4) monitoring rates of wood depletion of dead surface wood and wood collected from living plants.

Features

Four features were built to monitor the impact of stone on feature performance. All were basin shape, circular (60 centimeters in diameter), and about 30 centimeters deep. The substrate was sand. Three of the features had 4.44 kilograms of caliche added to the pit; the fourth feature lacked any caliche and was used as a control. All caliche added to each feature was similar in size, with all more than 2 inches in maximum diameter.

For each of the firing events, roughly the same amount of wood was collected by filling the same container to the top with wood. While the total amount of wood used on any given feature varied, this variation was not great. Initially, only dead surface wood was collected. However, this source was quickly depleted and wood collection expanded to include all available wood. For each collection event, the time required to gather the wood was recorded.

Each feature was lighted and the temperature measured with a digital thermometer and a thermocouple. As the recorded temperature varied considerably depending on where in the feature the thermocouple was placed, nine measurements were made at 30-minute intervals and averaged to arrive at a temperature for the feature at that time. Numerous experiments were conducted before a satisfactory way to monitor the temperature was determined. Eventually, two sets of average temperatures, one over 6 hours and one over 9 hours, were acquired.

After one, four, and seven events, the three features with caliche were excavated, and screened through one-eighth-inch mesh. These were then measured, and compared to the original size estimates (see Figure 9.10). The total loss of caliche weight in the first feature, which was fired a single time, was 5.7 percent. The second feature, with four firings, lost 7.4 percent and the caliche weight of the feature with seven firings was 7.7 percent. These weights were taken immediately after the collection of the caliche. Some of this weight loss certainly represented moisture being driven off the caliche. Most of it, however, probably reflected the loss of caliche. After heating, some of the outer surfaces of the caliche crumbled. Also as the caliche split, small spalls, many less then one-eighth inch in size, were produced. These were lost in the screening process and probably account for most of the weight loss.

Stone Types

Caliche was the major stone type recorded on Project 90-11, with many of the secondary types such as rhyolite, quartzite, sandstone, and granite being reused or scavenged artifacts rather then acquired directly for use in hearths. The primary exception to this was limestone, which generally did not have previous uses as other artifacts.

A second set of experiments explored the effect of heating on stone types. This was an attempt to understand why different stone may have been selected. The procedures involved heating limestone and caliche for a given time over a gas flame. These were then immersed in water, and the temperature of the water was measured over a given period.

Initially, three experiments were conducted to monitor the dissipation of heat stored in the stones. In each experiment, stones were heated over a consistent gas flame for 20 minutes. The stone was then placed in 4 liters of water, and the temperature of the water monitored every minute. The results (Figure J1) suggest that stone type has little affect on the overall pattern. Rather, weight seems to be the critical variable.

To explore the impact of weight further, a second series of ten experiments was conducted; four used various weights of limestone, two used Stage 4 caliche, and two used Stage 3/4 caliche. The final two experiments were conducted with rhyolite and quartzite. Each stone type was heated for 30 minutes over a consistent gas flame, then placed in 2 liters of water, and the temperatures recorded every minute for a 30-minute period. The time was extended from the 20 minutes used in the first experimental set to insure complete heating. Similarly, the amount of water was reduced to measure more closely the heat of the stones.

As with the previous experimental set, there appears to be little difference in the type of stone (Figure J2). The weight of the stone is the best predictor of average temperature over the 30-minute period. These results were surprising. We expected that different stone types, given radical differences in density, would behave differently.

Finally, a series of longer heating experiments was conducted on several samples of caliche, limestone, rhyolite, and quartzite. They were heated as previously described for 1 hour, immersed in 2 liters of water, and the temperature monitored for 34 minutes. As before, the overall temperature was closely correlated with the weight of the sample. To correct for weight differences and isolate the impact of the stone type, the absolute temperature was converted to degrees above the water temperature. These 34 measurements were averaged and the average temperature used as a zero point to allow all four stone types to be plotted on the same scale, and to look at the pattern of heat dissipation over the 34-minute period. For example, the 267-gram sample of caliche raised the water an average of 17 degrees; after 1 minute, the water was 10 degrees above the starting temperature, which was plotted as 7 degrees below 17.

The overall patterns of heat dispersion for stone types are different (Figure J3). Quartzite and, to a lesser degree, rhyolite, heated the water quickly to a high temperature. Conversely limestone, and to a lesser extent caliche, heated the water more slowly. The temperature for both quartzite and rhyolite then dropped rather quickly. Caliche maintained a relatively low plateau for 6 minutes, and then followed the pattern of rhyolite and quartzite by dropping below the average temperature at between 18 and 21 minutes. The limestone sample, however, maintained an above average temperature until the 24-minute mark. Thus, the dissipation of heat does differ between the various stone types.

These results are different from those presented previously (see Figure J1), where roughly similar weights of limestone and caliche had similar patterns of heat dispersion. The lack of differentiation between materials in the previous experimental set may be related to the relatively short heating period (20 minutes) in that experiment. The heat dispersion results suggest that different patterns of heat retention could play a role in the differential selection of stone for features.

However, the selection of stone types may not be related solely to the heat retention and/or dispersion capacity of the stone. Limestone is considerably denser than caliche, and thus substantially less volume of limestone is required to produce the same weight. When a given weight of stone is required to produce high temperatures over long periods of time, the volume of caliche required to produce an equivalent amount of heat would be substantially larger than limestone, rhyolite, or other dense rock.

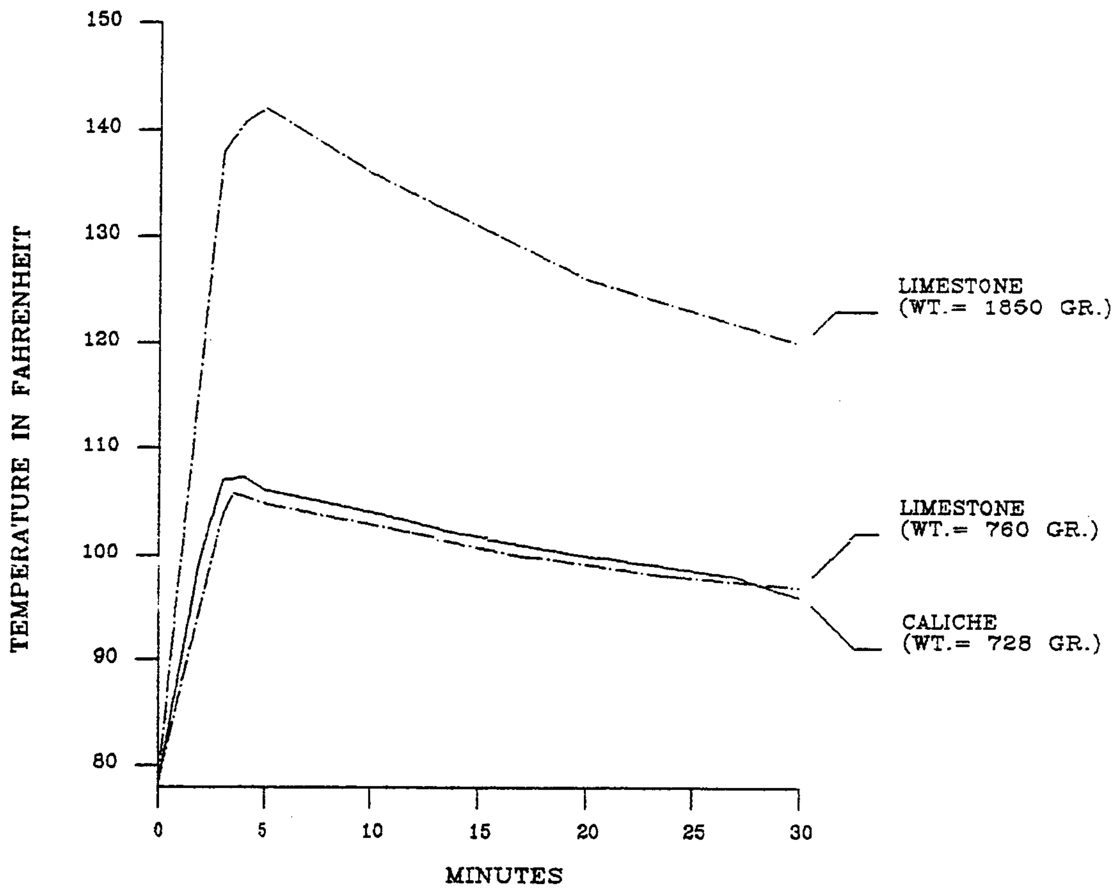

Figure J1. Temperature Patterns in Caliche and Limestone.

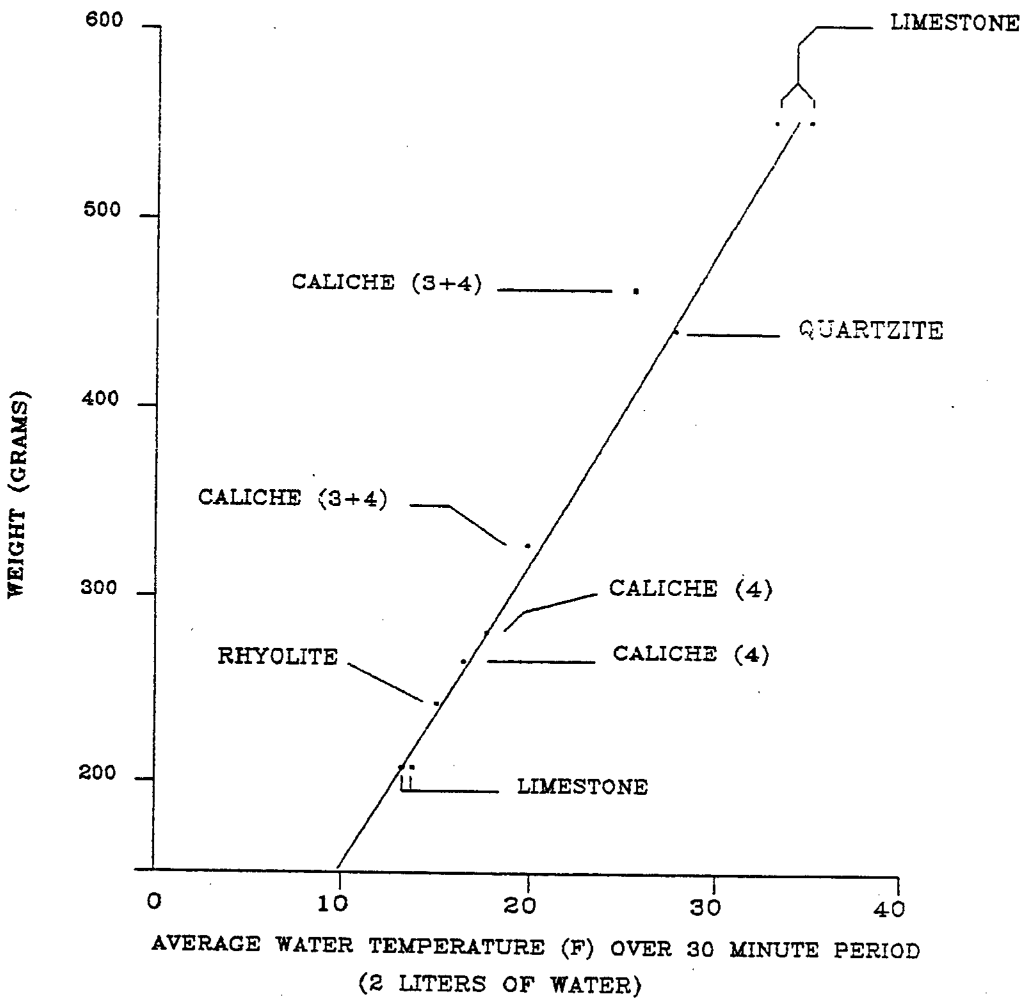

Figure J2. Average Temperature and Weight of Stone Types after Heating.

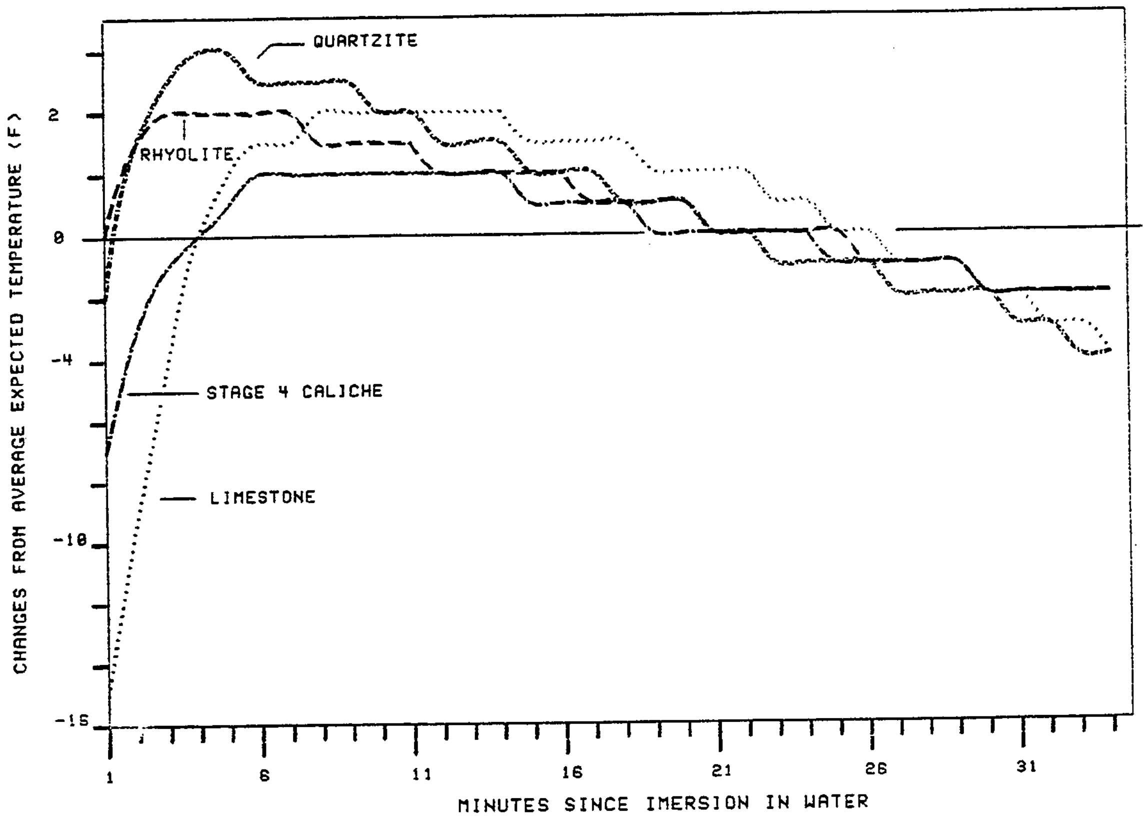

Figure J3. Heat Dissipation Patterns in Stone Types (corrected for differences in sample weights).

Appendix K

ANALYSIS OF FLOTATION SAMPLES FROM 16 ARCHEOLOGICAL SITES, THE SMALL SITES PROJECT (90-11), FORT BLISS MILITARY RESERVATION, TEXAS*

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INTRODUCTION

Archeological investigations have been conducted for many years in the central Hueco Bolson at Fort Bliss, Texas, and have produced thousands of typically small sites often lacking temporally diagnostic artifacts. The Small Site Project (90-11) was devised in 1990 to investigate the "small sites problem" utilizing survey, surface collection, and test excavations, under the general direction of Raymond Mauldin, Fort Bliss (FB). Purposes of the project focused on temporal, functional, and adaptive research questions (Mauldin and Graves 1991: 1).

Numerous flotation samples were taken from various features recognized in the project area. Of these, 30 were submitted to Archeobotanical Services (AS), Santa Fe, New Mexico, for analysis. The analysis was directed at recording the simple presence of charred botanical remains (scan) rather than quantification of those remains (full sort). I have not visited the site area.

Very few charred seeds or other plant remains were observed in the scan of the flotation samples. These results are discussed following a presentation of laboratory techniques and theoretical issues.

Laboratory Techniques

From 1.3 liters to 3.0 liters of fill were subjected to flotation, rather than the more traditional 1-liter sample, in an effort to preconcentrate charred remains expected to occur in low numbers. The actual flotation of the 30 samples was accomplished by AS personnel following the general procedure advocated by Castetter Laboratory for Ethnobotanical Studies, University of New Mexico, Albuquerque. In summary, this procedure involved dumping the dry soil sample into water, mixing slightly, and pouring water and suspended light fraction into chiffon cloth supported by a fine screen. Addition of more water and stirring of the residue, followed by pouring off the light fraction, was repeated three times.

The residual heavy fraction was dried and returned to Fort Bliss. The fine floated matter was dried and screened through a series of geological sieves for convenience in examination at the microscope. Material falling through the lowest 0.5-millimeter screen was labeled as "fine." Residues from each screen and the fines were placed in labeled coin envelopes. All flotation light fractions were returned to Fort Bliss following analysis.

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Conventions at the Microscope

The recovery of light fractions was variable across the samples from Project 90-11, and was not a function of sample size. It had been agreed in consultation with the archeologist that up to about 80 milliliters of light fraction greater than 0.5 millimeters in size would be examined from each sample; thus, 90 milliliters of light fraction from sample 50-362 (FB12072) was examined out of 105 milliliters actually recovered. The other 29 sample light fractions were examined in their entirety.

For the samples reported here, all items except the fines were scanned, or examined in a relatively speedy manner, by systematically raking through each screen's residue in a petri dish using a dissection probe, while observing with a stereoscope at a magnification of at least 7.5x. This size range is likely to comprise corn kernels and cupules, for example. Of the items smaller than 2.0 millimeters, only those with more than a single occurrence are apt to be seen in a scan. Scanning, then, can reflect the presence (or absence) of larger items, but only the relative abundance of smaller items. That is, rare small items are likely to be tallied as "absent." The presence of charred and uncharred plant and animal material was tabulated but not quantified during the scans of the Project 90-11 samples. It was noted, however, that no more than one charred seed was seen in any of the samples. Representations of each identified item were placed in gelatin capsules for quick location in any future reexamination, and bagged in the coin envelopes along with each screen's residue.

The usual second step of a flotation analysis is to conduct a full sort of the light fraction residues, during which all charred seeds are retrieved and counted. This procedure yields the number of seeds per unit of bulk sample before flotation, and is comparable from sample to sample; however, the apparent increase in precision does not necessarily reflect past environment or human behavior.

Identifications of seeds were made by comparison to published works (Martin and Barkley 1961; Musil 1963; Reed 1970), as well as to physical reference specimens. Following Minnis (for example, 1978: 362) and in consideration of the nature of the archaeological features in the project area, only charred materials were interpreted to be of archaeological origin. All other materials were judged to be recent (non-archaeological) additions to the archaeological record.

Limitations of Flotation Data

Flotation samples are generally taken to gather information on past plant use and, indirectly, past environment. Yet, because archaeological sites are prone to disturbance by rodents and bioturbation by insects and other biological agents, uncharred plant remains must usually be viewed as more recent introductions and excluded from archaeological interpretation. This means that charred remains are usually the focus of flotation analysis, and contexts containing ash and charcoal are common sampling locations.

Flotation samples can often yield great quantities of material, quickly overwhelming the microscopist. It is difficult equitably to subsample plant remains of greatly varying sizes, shapes, and weights, and it has long been traditional to subsample instead at the level of the bulk soil sample. Such a subsample is commonly a 1-or 2-liter volume of unfloated feature matrix, and even 1 liter of unfloated matrix will yield remains of the most common plants once present at many archaeological sites in New Mexico. Sites in southern New Mexico, on the other hand, frequently yield very low numbers of remains from the flotation of feature matrix. Subsampling before flotation, as was done with the Project 90-11 samples, can introduce considerable analytical bias when the small-volume subsample is taken from a feature yielding, say, 10 or more liters, as is not uncommon. In many situations, subsampling unfloated feature matrix greatly reduces the chances that rare remains will be included in the flotation subsample and eventually presented to the microscopist for examination.

Plant remains are usually carbonized accidentally, however, and even the recovery of carbonized plant remains does not necessarily reflect past environment or human behavior. That is to say, even if a particular plant or plant part was an important food source to a past human population, little evidence of that importance would appear in the flotation or microbotanical record if no accidents caused carbonization and preservation of identifiable remains.

Assessing the numbers of recovered plant remains by means of a scan or a full sort realistically reflects only those remains, and that is not necessarily the same as reflecting the environment or food preferences of the group under consideration. Sparse carbonized plant records may mean that other, non-*carbonized* plants were the past target resources, or that other, non-*plant* resources were the focus of activities conducted at the sites.

To summarize, the analysis of flotation samples usually concentrates on charred plant remains in a conservative effort to exclude non-archaeological uncharred elements introduced to the sampling locus by disturbance and bioturbation. All the light fraction greater than 0.5 millimeters recovered from 29 of the 30 flotation samples were examined microscopically; the low yield of carbonized seeds is not the result of a sampling error at the microscope.

RESULTS

As shown in Table K1, volumes of from 1.34 liters to 3.0 liters (median 2.19 liters) were subjected to flotation for this study; volumes of recovered light fraction (greater than 0.5 millimeters) varied from 12 milliliters to 105 milliliters (median 28.5 milliliters). Few if any of the volumes represent the complete fill of the sampled features, judging from figures given for the dimensions of the sampled features (Mauldin and Graves 1991: 40–43).

Table K1. Proveniences and Flotation Recovery Rates.

Site Number and Sample G	Volume of Feature Fill Floated	Volume (ml) of Light Fraction Recovered*	Provenience
FB6741			
G-1335-362-1	1,970	16	Feature 152
G-1337-362-1	1,840	20	Feature 7
FB7483			
G-241-362-1	3,000	34+	Feature 19
G-245-362-1	1,920	25	Feature 32
G-247-362-1	2,000	23+	Feature 6
G-248-362-1	1,460	18+	Feature 12
G-289-362-1	2,000	65	Feature 14
G-364-362-1	2,000	44+	Feature 13
FB7508			
G-80-362-1	2,370	60	Feature 7
FB7510			
G-702-362-1	2,100	19+	Feature 68
FB7517			
G-176-362-1	2,110	45	Feature 45
FB7547			
G-402-362-1	2,330	17+	Feature 85
G-403-362-1	1,750	17+	Feature 86
G-404-362-1	2,600	39+	Feature 3
FB7580			
G-159-362-1	2,670	28+	Feature 26
FB10411			
G-118-362-1	2,500	14+	Feature 16
FB12069			
G-109-362-1	2,270	30	Feature 15
G-110-362-1	2,630	30	Feature 7
FB12072			
G-30-362-1	2,850	50	Feature 15
G-46-362-1	2,670	29+	Feature 17
G-47-362-1	2,040	39+	Feature 12
G-50-362-1	2,770	105	Feature 6
FB12100			
G-159-362-1	1,340	12+	Feature 7
FB12102			
G-145-362-1	2,000	55	Feature 3
G-147-362-1	2,090	19+	Feature 3
FB12218			
G-82-362-1	1,500	18+	Feature 4
FB12224			
G-16-362-1	2,620	45	Feature 4
FB12225			
G-2-362-1	2,500	23+	Feature 1
FB12243			
G-36-362-1	2,500	24+	Feature 1
FB12330			
G-18-362-1	2,750	40	Feature 3

* *Fine fraction (< .5 mm) not examined; fine fraction volumes not measured or included here; 100% of remaining volumes examined except Sample G-50-362, FB12072 (90 of 105 ml examined).*

\+ *Volumes are estimated to the nearest 5 ml; smaller volumes arbitrarily assigned a 4-ml volume; +16 ml is greatest possible error (Sample G-1335-362, FB6741).*

Tables K2 and K3 present the charred botanical macroremains identified during the scans of the 30 flotation samples reported here. All samples contained indications of disturbance. Single purslane seeds were seen in two samples from sites FB6741 and FB7483, but the charred condition of the seeds could not be positively determined and they are indicated as "charred?" in Table K3. The single goosefoot seed seen from FB7483 is the only positively identified charred botanical macroremain. One or another unidentifiable charred plant remains was seen in an additional three samples, one each from FB6741, FB10411, and FB12069.

Previous work I and others have conducted on flotation samples from southern New Mexico indicates that it is common to have a low return of charred plant material from site features in that region. This collective experience has prompted some archaeologists to subject the entire fill of the features to flotation in a routine effort to preconcentrate charred plant remains.

> Based on previous studies in the area, it was expected that flotation samples from the mitigated sites in the GBFELTIE study area sites would have very low densities of archaeological plant remains. For this reason, flotation samples larger than those usually employed in most other areas of the Southwest were taken, ranging from 0.25 to 143.5 liters of soil. In archaeological deposits in the Southwest with better preservation of plant remains, samples as large as these are unnecessary and unusual. However, results of this analysis have demonstrated that a low density of preserved botanical material is present in the samples, making the collection of large samples a wise decision (Minnis 1991: 387).

The potential charred seed content of the ephemeral features sampled in the Fort Bliss Project 90-11 was probably low. The activities that produced the recognized features may have been short in duration, and over time wind and water erosion dispersed the charred remains of those activities into "stains." The combination of these events makes it very unlikely that any charred seeds would be seen in a sample comprising any smaller volume than the entire fill of such features.

The current scanty Project 90-11 data indicate that goosefoot and possibly purslane plant products were present in the immediate area during the time some of the "stain" and "rock/stain" features were being formed. The absence of such data from the vast majority of the samples does not mean that goosefoot, purslane, or other plant products were not used elsewhere in the project area. The features presently negative for charred seeds may have been created in connection with activities involving non-plant resources. It is equally likely that the features were created in connection with activities involving plant resources that did not undergo the fortuitous accidental charring needed to preserve evidence of those activities, or that any charred plant materials indeed present in the features were not included in the subsamples submitted for flotation analysis.

Questions of the feature function at the 16 sites reported here cannot be explored with the current data. I recommend that future flotation samples from these types of dispersed features be (much) larger in volume, and preferably comprise all the feature fill whenever possible, to have half a chance of recovering plant evidence of activities in the Project 90-11 area.

Table K2. Charred Plant Remains Identified from Flotation Samples.

Taxon	Common Name
Chenopodium	Goosefoot
Portulaca	Purslane

Table K3. Charred Remains Found in Scans of Flotation Samples.

Sample	Disturbance	Chenopodium	Portulaca	Other	Provenience
FB6741					
G-1335-362-1	a, b, c	–	+?	f	F-152
G-1337-362-1	a, b, c, d	–	–	f, k	F-7
FB7483					
G-241-362-1	a, b, c	–	–	f	F-19
G-245-362-1	a, b, c, d	0	–	f	F-32
G-247-362-1	a, b, c	–	+?	f	F-6
G-248-362-1	a, b, c, d	–	–	f	F-12
G-289-362-1	a, b, c, d	–	–	f	F-14
G-364-362-1	a, b, c	–	–	f	F-13
FB7508					
G-80-362-1	a, b, c	–	–	f	F-7
FB7510					
G-702-362-1	a, b, c	–	–	f	F-68
FB7517					
G-176-362-1	a, b, c	–	–	no f	F-45
FB7547					
G-402-362-1	a, b, c	–	–	j, no f	F-85
G-403-362-1	a, b, c	–	–	f, i	F-86
G-404-362-1	a, b, c, d	–	–	f	F-3
FB7580					
G-159-362-1	a, b, c	–	–	f	F-26
FB10411					
G-118-362-1	a, b, c	–	–	l, no f	F-16
FB12069					
G-109-362-1	a, b, c	–	–	f, m, n	F-15
G-110-362-1	a, b, c	–	–	f	F-7
FB12072					
G-30-362-1	a, b, c	–	–	f	F-15
G-46-362-1	a, b, c	–	–	f	F-17
G-47-362-1	a, b, c	–	–	f	F-12
G-50-362-1	a, b, c	–	–	f	F-6

(Continued on next page.)

Unless otherwise noted, only charred botanical remains included in table.

a: unburned rootlets
b: feces
c: chitin
d: unburned woody material
f: wood charcoal (>2 mm only)
i: unburned chert microflake
j: unburned rodent-sized
k: unidentified plant material (mesquite seed coat?)
l: unidentified plant material (charred starch or sap)
m: unidentified plant material (knobby bark-like str.)
n: ?grass seed

Table K3. Charred Remains Found in Scans of Flotation Samples (continued).

Sample	Disturbance	Chenopodium	Portulaca	Other	Provenience
FB12100					
G-159-362-1	a, b, c, d	–	–	f	F-7
FB12102					
G-145-362-1	a, b, c, d	–	–	f	F-3
G-147-362-1	a, b, c, d	–	–	f	F-3
FB12218					
G-82-362-1	a, b, c	–	–	f	F-4
FB12224					
G-16-362-1	a, b, c, d	–	–	f	F-4
FB12225					
G-2-362-1	a, b, c	–	–	f	F-1
FB12243					
G-36-362-1	a, b, c	–	–	f	F-1
FB12330					
G-18-362-1	a, b, c	–	–	f	F-3

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Appendix L

POLLEN AND FLOTATION ANALYSES OF SAMPLES FROM 16 ARCHAEOLOGICAL SITES, THE SMALL SITES PROJECT, FORT BLISS MILITARY RESERVATION, EL PASO COUNTY TEXAS*

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INTRODUCTION

Archaeological investigations have been underway for several years on small sites located within the confines of Fort Bliss, Texas. Previous investigations have recovered only small quantities of charred botanical materials (Dean 1992).

A large number of flotation samples were collected during field excavations from a variety of features. Of these, 49 were submitted to the Castetter Laboratory for Ethnobotanical Studies for examination. The analyses were aimed at identifying the simple presence of charred botanical materials (scans) rather than the more detailed quantification of those materials (full sort). I have not visited the project area.

Additionally, eight soil samples were submitted for pollen analysis. An additional four samples were submitted later after the results of the first eight samples. Abbreviated microscopy was requested for these samples to assess the potential for pollen preservation.

METHODS AND MATERIALS

Palynological Methods

Chemical extraction of pollen samples was conducted using a procedure designed for arid Southwestern sediments. The methodology specifically avoids use of such reagents as nitric acid, bleach, and potassium hydroxide, which have been demonstrated experimentally (Holloway 1981) to be destructive to pollen grains.

Initially, 25 milliliters of soil were subsampled and prior to chemical extraction, three tablets of concentrated *Lycopodium* spores (Batch #414831, Dept. Quat. Geol., Lund, Sweden) were added to each subsample for a total of 36,231 marker grains each. This was done to permit the later calculation of pollen concentration values and secondly, to serve as a marker against accidental destruction of the pollen assemblage by laboratory methods. To be consistent with other analyses (Dean 1990), each sample was weighed and the weight recorded prior to chemical extraction. The samples were initially treated with 35 percent hydrochloric acid to remove carbonates and to release the *Lycopodium* spores from their matrix. After neutralizing the acid with distilled water, the samples was allowed to settle for at least three hours before the supernatant liquid was removed. Additional distilled water was added, the mixture swirled, and then allowed to settle for 5 seconds. The suspended fine fraction was decanted from the original mixture through 230μ mesh screen into a second beaker. This procedure, repeated at least three times, differentially removed lighter materials, including

* *Castetter Laboratory for Ethnobotanical Studies, Technical Series Report* Number 340, September 1992 (Revised January 1993).

pollen grains, from the heavier fractions. The fine material was concentrated by centrifugation at 2,000 RPM.

This fine fraction was treated with cold 49 percent HF overnight to remove silicates. After neutralizing the acid with distilled water, trisodium phosphate (Na_3PO_4, 2.5 percent) was added to each sample. This material was repeatedly washed out by rinsing with distilled water followed by centrifugation at 2,000 RPM. This procedure removed fine charcoal and other associated organic matter and the procedure was continued until the supernatant liquid was clear after centrifugation. The residues were washed with glacial acetic acid to remove any remaining water in preparation for acetolysis.

Acetolysis solution (acetic anhydride: conc. sulfuric acid in 9:1 ratio) following Erdtman (1960) was added to each sample. The tubes were heated in a boiling water bath for 5 minutes and allowed to cool down an additional 5 minutes before centrifugation and removal of the acetolysis solution. The samples were washed with glacial acetic acid to remove all traces of the acetolysis solution prior to multiple washes with hot distilled water. Centrifugation at 2,000 RPM for 90 seconds dramatically reduced the size of the sample and from periodic examination of the residue did not remove fossil palynomorphs.

The residues were treated with a heavy density separation using zinc chloride (S.G. 1.99-2.00) to remove other small inorganic particles. The lighter organic portion was removed by pipette, diluted with distilled water (10:1) and concentrated with distilled water. The residue was repeatedly washed with distilled water and centrifugation until the supernatant liquid was clear. The material was rinsed in methanol stained with safranin O suspended in a methanol solution. Three rinses with methanol effectively destained the samples, which were transferred to 1-dram vials with tertiary butyl alcohol (TBA). Subsequent washes (90 second centrifugation) with TBA effectively reduced the residue size of large samples by removing fine charcoal and organic materials. The samples were mixed with a small quantity of 1,000 centistoke (cks) silicon oil and allowed to stand overnight for evaporation of the TBA. The storage vials were capped and are in permanent storage at Castetter Laboratory for Ethnobotanical Studies (CLES). The unused portion of the sediment samples were returned to Fort Bliss for curation.

A drop of the polliniferous residue was mounted on a microscope slide for examination under 18-by-18 millimeter cover slips, which were sealed with fingernail polish. The slide was examined using 250 or 400-power magnification under an aus-Jena Laboval 4 compound microscope. Since preliminary (scan) analyses of abbreviated microscopy were requested for each sample, a minimum count of 200 grains per sample was not conducted. Rather, tabulation continued until 50 marker grains had been counted. After obtaining this preliminary count, the remainder of the slide was examined at 100-power magnification for the presence of cultigen pollen types such as *Zea mays*, *Cucurbita*, or members of the families Malvaceae, Cactaceae, or Nyctaginaceae.

Pollen concentration values were computed for each sample using the following formula:

$$PC = \frac{K*p}{L*S}$$

Where:

PC = Pollen concentration
K = *Lycopodium* spores added
p = Sum of fossil pollen counted
L = Sum of *Lycopodium* spores counted
S = Sediment volume

Statistically, the concentration values provide a more reliable estimate since a minimum number of marker grains are counted rather than fossil grains. Percentage calculations are based on counts less than 200 grains (Barkley 1934) and should be viewed with caution. Secondly, since percentage calculations sum to unity, a change in any single taxon frequency necessitates changes, no matter how small, to all other taxa. This does not occur in the calculation of concentration values.

Pollen grains were identified to the lowest taxonomic level whenever possible. The identifications conformed to existing levels of taxonomy with a few exceptions. For example, the category Cheno-am is an artificial, pollen morphological category that includes pollen of the Chenopodiaceae (goosefoot) and the genus *Amaranthus* (pigweed) that are indistinguishable from each other (Martin 1963). All members are wind pollinated (anemophilous) and produce very large quantities of pollen. In many sediment samples from the American Southwest, this taxon often predominates the assemblage.

Pollen of the Asteraceae (Composite) family were divided into four groups. The high spine and low spine groups were identified on the basis of microscopic spine length of the grains. High spine Asteraceae was defined as those grains with spines greater or equal to 2.5µ in length while the low spine group contained spines less than 2.5µ in length. *Artemisia* is identifiable to the genus level due to its unique morphology of a double tectum in the mesocopial (between furrows) region of the pollen grain. Pollen grains of Liguliflorae are also distinct in shape having a fenestrate type pollen grain. Grains of this type are restricted to the tribe Cichoreae, which includes such genera as *Taraxacum* (dandelion) and *Lactuca* (lettuce).

Pollen of the Poaceae (grass) family are generally indistinguishable below the family level, the single exception being pollen of *Zea mays*. All members of the family contain a single pore, are spherical, and have simple wall architecture. Identification of non-corn pollen is dependent on the presence of the single pore. Only grains, or grain fragments containing this pore were tabulated as members of the Poaceae.

Flotation Methodology

A standard sample of 2 liters was used throughout. The soil had previously been subjected to physical separation by personnel at Fort Bliss. Only the light fraction material was sent to CLES for analysis.

The light fraction was volumetrically measured prior to analysis. The contents of each light fraction was examined using a stereoscopic zoom microscope (8-to-40-power magnification). During the scan analysis the taxa encountered were recorded. By convention only carbonized remains were tabulated and analyzed. In some cases uncarbonized materials were identified.

Identifications of seeds were made by comparisons to several references (Martin and Barkley 1961; Montgomery 1977; Schopmeyer 1974) in addition to the modern seed collection housed in the Biology Department Herbarium at The University of New Mexico. Wood charcoal identifications were based on published reference texts (Panshin and deZeeuw 1980) and a computer-assisted wood identification program (Wheeler et al. 1986), in addition to the modern wood charcoal collection maintained at CLES in Albuquerque.

RESULTS

For ease in conversion, tables at the end of the report list scientific and common names of taxa mentioned in the text (Table L1), the results of the macrobotanical identifications (Table L2, and the results of the pollen analysis of the column from FB7483 (Tables L3, L4, L5). The results are presented below by site order.

FB6741

Feature 135 (G1799) produced very little material but was dated to 4803–4314 years B.P. Charcoal fragments too small for identification and insect remains were the only materials recovered. These same materials were also recovered from Feature 133 (G1840), which was undated. An uncharred grass floret was also found as was a specimen listed as Unknown A. Unknown A is a charred fragment of a structure found repeatedly in archaeological sites from southern New Mexico and West Texas. It is unusual in that it has small processes present on the surface.

FB7483

A total of five flotation samples was analyzed from this site. Sample G283 from Feature 16 contained a single charred seed from the Caryophyllaceae family. An additional sample from this feature (G461) contained charred and uncharred debris. *Pinus* charcoal was recovered from Feature 7 (G297), 2356–2149 years B.P., in addition to an uncharred *Cycloma* seed. Feature 43 (G457) contained charcoal of both a member of the Fabaceae family as well as *Populus* (cottonwood). This feature dates to 2747–2397 years B.P. Several woody members of the Fabaceae family are located within this region including *Prosopis*, *Robinia*, and *Acacia*. However, the specimens were small enough so as to preclude a more precise identification. Uncharred petals from a small flower were also recovered from Feature 38 (G465), which dated to 1412–1296 years B.P.

Eight pollen samples were submitted for analysis (Table L4). These samples were distributed from 30–148 centimeters below surface. Only two

samples, 1 (30–40 cm) and 4 (82–88 cm), contained pollen concentration values in excess of 1,000 grains per milliliter. While this is not an absolute threshold, concentration values below 1,000 grains per milliliter are generally highly weathered. As such they are generally suspect. Additionally, all eight samples contained indeterminate pollen in excess of 20 percent. The indeterminate category includes those grains whose surface has been so weathered as to preclude identification. The analyst can tell that it is a pollen grain but nothing more. An assemblage with low concentration values and high percentages of indeterminate pollen indicates a severely weathered assemblage that should be viewed with extreme caution. As such, no attempt was made to produce 200 grain counts on these assemblages and counting was terminated after counting 50 marker grains because of the severe weathering and deterioration of the pollen assemblage.

The second set of samples from location G492 was distributed between 90 and 138 centimeters below surface. Only one sample (105–109 cm) contained pollen concentration values in excess of 1000 grains per gram (1127 grains/gm). All four samples contained low pollen concentration values and fairly high percentages of indeterminate type pollen. The assemblage was very similar to the initial eight samples examined and was dominated by Cheno-am and Asteraceae type pollen. A single grain of *Platyopuntia* pollen was recovered from the 105-to-109-centimeter level and a single grain of *Zea mays* pollen was recovered from the 130-to-138-centimeter level.

FB7484

A single flotation sample (G260) was recovered from this site. The remains included several charred grass stems in addition to small charcoal fragments and insect remains.

FB7510

The sample (G728) from Feature 40 contained Fabaceae charcoal and an uncharred flower and dated to 1542–1352 years B.P. The remainder of the samples from this site, G729 from Feature 38, which dated to 1415–1300 years B.P., and G722 from Feature 74, which dated to 1520–1360 years B.P., contained only charcoal fragments and a small quantity of insect remains.

FB7520

This sample (G483) from Feature 2 contained unidentified conifer wood. The specimen was too small to identify it to genus. The feature dated to 6661–6289 years B.P.

FB7547

Two samples were analyzed from this site, G499 (Feature 90) and G531 (Feature 54, 1420–1194 years B.P.). In addition to charcoal fragments and insect remains only a single uncharred *Cycloma* seed was recovered.

FB7580

Two samples were submitted from this site. Sample G186 (Feature 4, 1890–1610 years B.P.) and an older sample, G192 (Feature 8, 3160–2800 years B.P.), contained charcoal fragments and a small quantity of insect remains.

FB10411

Two samples were analyzed from this site: G247 (Feature 17, 930–670 years B.P.) and G118 (Feature 16, 730–540 years B.P.). Both samples contained small numbers of Caryophyllaceae seeds. Sample G247 also contained >20 *Chenopodium* seeds.

FB10416

This sample (G25) was taken from Feature 2. Only charcoal fragments and insect remains were present.

FB11299

Sample G41 was taken from Feature 9. This material contained Fabaceae charcoal and charcoal fragments and dated to 905–675 years B.P.

FB12069

Five samples were analyzed from this site. Unknown A was found in Feature 16 (G156, 1540–1392 years B.P.). Two additional samples from this feature (G147 and G152) contained only small charcoal fragments and insect remains. Feature 22 (G162, 1410–1180 years B.P.) contained Fabaceae and *Populus* charcoal. Feature 20 (G163), contained a charred grass stem.

FB12072

Fabaceae charcoal was recovered in Sample G79. This sample was taken from Feature 20, which dated to 2037–1820 years B.P.

FB12100

Ten samples were submitted from this site. Fabaceae charcoal was the only identifiable material and was found only in Sample G287 from Feature 27, which dated to 1055–926 years B.P. The remainder of the material consisted almost entirely of charcoal fragments too small to identify.

FB12225

Sample G13 was recovered from Feature 2 and dated to 3321–2881 years B.P. Only charcoal fragments and a small fecal pellet were recovered.

FB12316

Feature 9 (G56, 2739–2329 years B.P.) contained only small charcoal fragments. The sample from Feature 10 (G59) contained charcoal fragments and a large quantity of uncharred debris.

FB12330

Ten samples were analyzed from this site. All contained small charcoal fragments. *Portulaca* seeds were found in Feature 13 (G180, 1173–959 years B.P.) and in Feature 1 (G216, 1410–1193 years B.P.). *Atriplex/Sarcobatus* charcoal was found in Features 7 (G128, 1173–959 years B.P.) and 13 (G180). Fabaceae charcoal was present in Feature 7 (G128) as were more than 20 Caryophyllaceae seeds (G201). This sample (G201) also contained a suspected resin droplet still adhering to a stem. Charred grass stem was present in Feature 13 (G180) while uncharred grass stems were present in Feature 2 (G47, 2149–1870 years B.P.).

FB12331

Two samples were analyzed from this site. The remains included uncharred debris and charcoal fragments. Feature 3 dated to 2298–1890 years B.P. while Feature 5 was undated.

DISCUSSION

The majority of the flotation samples selected for analysis consisted of 2,000 milliliters of soil prior to separation. Although few samples departed from this average, the range was from 600 to 2,500 milliliters. Table L3 provides the percentage of light fraction recovered from each of these samples and indicates that the majority (37 of 49 samples or 75 percent) contained less than 2 percent by volume of organic material. As noted in Table L2, the number of organic remains in any given sample was very low.

Other research in southern New Mexico and extreme West Texas indicates that a low percentage of charred botanical materials from archaeological features is the norm (Dean 1990; Minnis 1991). Minnis (1991: 387) for example, recommends that the entire contents of features be subjected to flotation. This also reflects what can be referred to as the "rare taxon phenomena." In several cases, the items identified during the scans were present in only one occurrence. In all cases, the distribution of these single remains occurs less than one per liter. Luckily, these taxa were present in the particular liter of sediment selected for examination. How many other types of charred remains were present in the portions not selected for analysis?

In other areas of the Southwest, where large quantities of charred remains are the norm, it is not necessary to sample large quantities of feature fill. However, in those areas of the state where few remains have been recovered, it is preferable to extract all the fill and let the analyst scan for additional taxa. In this way we are more confident that taxa not present are missing rather than missing due to sampling error.

In spite of the low number of remains recovered from these sites, quite a diversity of taxa were recovered (Table L2). Three features were described as amorphous, a single feature as cylindrical, while the remainder of the samples were either oval or circular basins. The vast majority of materials were not associated with one type of basin or the other. Fabaceae and *Populus* charcoal were both recovered from both basin types. However, the charred grass stems or grass florets were primarily recovered from the oval type basin. This *suggests* that the basins may have served slightly different functions. However, the macrobotanical analyses of these features cannot

at this point shed light on what that function may have been. The grass material may simply have been a cover that later burned or the pit could have been grass lined.

Several features were radiocarbon dated. *Populus* charcoal was recovered from Feature 43 on FB7483 (2747–2397 years B.P.) and Feature 22 on FB12069 (1410–1180 years B.P.). The presence of this taxon may indicate that *Populus* was present closer to the site areas than at present. Since *Populus* requires more water, a proximity to drainage may be inferred. Alternatively, this may simply signify that in other deposits, equally suitable fuel sources such as mesquite, for example, were more readily and easily accessible.

Conifer wood charcoal was rarely recovered. *Pinus* charcoal is present from one feature dated to 2356 to 21,491 years B.P. A resin droplet attached to a juniper stem was recovered from FB12330 but this was uncharred and may be modern intrusion. Alternatively, the softer conifer woods may have been more completely incinerated thus leaving little evidence. The majority of the wood charcoal belongs to the Fabaceae family and may belong to any number of genera. Many of these genera occur consistently throughout this area such as *Prosopis* and *Acacia* and it is likely that the Fabaceae charcoal reflect locally collected woody legumes.

Several features contained wood charcoal of *Atriplex/Sarcobatus*. Morphologically, the wood structure of these two taxa are identical. While it is probable that most of these are *Atriplex*, since *Sarcobatus* does occur in the area, it is impossible to separate these two wood types. This wood charcoal type occurred in Feature 7 on FB12330, a structure, and Feature 13, a posthole within the structure. These features date to 1173–959 years B.P.

The palynological data was not very productive. The majority of the samples were severely eroded and weathered as indicated by the low concentration values and the high percentages of indeterminate pollen. However, the lower levels from area G492 provided evidence of economic type pollen. The presence of both *Platyopuntia* and corn pollen are important. The corn pollen is the first direct evidence of cultivated crops obtained from these sites. The corn was present in the lowest level from G492. This level may be associated with a feature dated to 3631–3359 years B.P. This may appear slightly earlier than expected for this taxon. Alternatively, since only a single grain was recovered, this might be the result of downward movement from the upper levels. Based on only a single grain, it is not possible at this time determine which explanation is more likely.

CONCLUSIONS

Relatively few seed types were recovered from these sites. *Chenopodium* and *Portulaca* were the most common but even these were in low amounts, similar to other studies (Dean 1992). These were not charred. A few seeds of the Caryophyllaceae family were also present and some of these were charred. *Cycloma*, a member of the Chenopodiaceae family was present but never charred. It may be a modern contaminant. Fabaceae charcoal was the most common with occurrences of *Pinus* and *Populus*. Charred grass material is present as well.

As yet, there is insufficient evidence to explore questions of feature function. Perhaps a larger volume of material may be necessary in order to obtain the necessary data. There does seem to be, however, a pattern of local exploitation of available resources for fuel. Corn was recovered from a single sample. The presence of this cultivar indicates a slightly earlier date and may compare with other materials from the Organ Mountains and possibly Fresnal Shelter.

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Table L1. Scientific and Common Names of Taxa.

Scientific	Common	Scientific	Common
Acacia	Catclaw	Liguliflorae	Tribe of composite family
Amaranthus	Pigweed	*Lycopodium*	Clubmoss-marker
Artemisia	Sagebrush	Malvaceae	Cotton family
Asteraceae	Composite family	Nyctaginaceae	Desert four o'clock family
Atriplex	Saltbush	*Pinus*	Pine
Cactaceae	Cactus family	Poaceae	Grass family
Caryophyllaceae	Pink family	*Populus*	Cottonwood
Cheno-am	Pollen morphological category	*Portulaca*	Purslane
Chenopodiaceae	Goosefoot family	*Prosopis*	Mesquite
Chenopodium	Goosefoot	*Robinia*	Locust
Cucurbita	Squash, gourd	*Sarcobatus*	Greasewood
Cycloma	None given	*Taraxacum*	Dandelion
Fabaceae	Bean family	*Zea mays*	Corn
Lactuca	Lettuce		

Table L2. Flotation Results by Site.

FB Site Number	Sample Number	Feature Number	Date	Identification
6741	1,799	135	4803–4314	cf., I
6741	1,840	133	–	I-gall, I, cf., unknown A, uncharred grass floret
7483	283	16	7429–6889	Caryophyllaceae seed charred. cf., I
7483	297	7	2356–2149	*Pinus* charcoal, cf., I, uncharred *Cycloma* seed
7483	457	43	2747–2397	cf., Fabaceae charcoal, cf. *Populus* charcoal, cf.
7483	461	16	7429–6889	cf., uncharred debris
7484	260	29	–	Charred grass stems, cf., I
7510	728	40	1542–1352	cf., I, Fabaceae charcoal, uncharred flower
7510	729	38	1415–1300	cf., I
7510	722	74	1520–1360	cf., I
7520	483	2	6661–6289	cf., I, uncharred conifer wood
7547	499	90	–	cf., I
7547	531	54	1420–1194	cf., I, uncharred *Cycloma*
7580	186	4	1890–1610	cf., I
7580	192	8	3160–2800	cf., I
10411	247	17	930–670	Chenopodium seeds >20, Caryophyllaceae seed
10411	118	16	730–540	cf., I, Caryophyllaceae seed
10416	25	2	–	cf., I
11299	41	9	905–675	cf., I, Fabaceae charcoal
12069	156	16	1540–1392	cf., I, unknown A
12069	147	16	1540–1392	cf., I
12069	163	20	–	cf., charred grass stem
12069	162	22	1410–1180	cf., Fabaceae charcoal, *Populus* charcoal
12069	152	16	1540–1392	cf., I
12072	79	20	2037–1820	cf., cf. Fabaceae charcoal
12100	284	27	1055–926	cf., I, FP
12100	287	27	1055–926	cf., cf. Fabaceae charcoal
12100	271	27	1055–926	cf., I
12100	289	27	1055–926	cf.
12100	293	35	–	cf.
12100	297	39/44	1055–926	cf.
12100	301	42	105–926	cf.
12100	304	46	1055–926	cf.
12100	308	31	1256–950	cf.
12100	309	32	1173–931	cf., I
12225	13	2	3321–2881	FP, cf.
12316	56	7/9	2739–2329	cf., I

(Continued on next page.)

Table L2. Flotation Results by Site (continued).

FB Site Number	Sample Number	Feature Number	Date	Identification
12316	59	10	–	cf., uncharred debris
12330	216	1	1410–1193	cf., I, *Portulaca* seed <5
12330	47	2	2149–1870	Unknown A, cf., uncharred grass stem
12330	180	13	1173–959	*Portulaca* seed. *Atriplex/Sarcobatus* charcoal, charred grass stem
12330	182	12	–	cf.
12330	128	7	1173–959	*Atriplex/Sarcobatus* charcoal, Fabaceae charcoal, cf.
12330	201	7	1173–959	Caryophyllaceae seed >20, cf., I, resin droplet on stem
12330	172	6	2146–1842	cf., I
12330	222	4	–	cf., I
12331	2	3	2298–1190	cf., I
12331	7	5	–	Uncharred debris

Table L3. Flotation Recovery Results.

FB Site Number	Sample Number	Feature Number	Initial Volume (ml)	Light (ml)	Light %
6741	1,786	135	2,000	30	0.02
6741	1,840	133	2,000	10	0.01
7483	283	7	2,000	5	0.00
7483	297	43	2,000	10	0.01
7483	457	16	600	125	0.21
7483	461	16	2,000	5	0.00
7483	465	38	2,000	100	0.05
7484	260	29	2,000	15	0.01
7510	730	40	2,000	80	0.04
7510	731	38	2,000	60	0.03
7510	732	74	2,000	60	0.03
7520	488	2	2,000	15	0.01
7547	528	54	2,000	5	0.00
7547	536	96	2,000	15	0.01
7580	186	4	2,000	10	0.01
7580	192	8	2,000	20	0.01
10411	163	17	2,000	60	0.03
10411	248	16	2,500	20	0.01
10416	25	2	2,000	15	0.01
11299	41	9	2,000	80	0.04
12069	156	20	2,000	5	0.00

(Continued on next page.)

Table L3. Flotation Recovery Results (continued).

FB Site Number	Sample Number	Feature Number	Initial Volume (ml)	Light (ml)	Light %
12069	158	22	2,000	10	0.01
12069	163	16	2,000	15	0.01
12069	167	16	2,000	30	0.02
12069	187	16	2,000	10	0.01
12072	79	20	2,000	40	0.02
12100	284	27	2,000	10	0.01
12100	287	27	2,000	20	0.01
12100	288	27	2,000	15	0.01
12100	289	27	2,000	15	0.01
12100	293	35	2,000	55	0.03
12100	297	39/4	2,000	30	0.02
12100	301	42	2,000	50	0.03
12100	304	46	2,000	80	0.04
12100	308	31	2,000	100	0.05
12100	309	32	2,000	80	0.04
12225	13	2	2,000	25	0.01
12316	56	9	2,000	15	0.01
12316	59	10	1,200	5	0.00
12330	17	1	2,000	10	0.01
12330	47	2	2,000	25	0.01
12330	180	4	2,000	5	0.00
12330	182	6	2,000	20	0.01
12330	193	13	1,100	15	0.01
12330	201	12	2,000	5	0.00
12330	218	7	2,000	20	0.01
12330	222	7	2,000	25	0.01
12331	2	3	2,000	15	0.01
12331	7	5	2,000	35	0.02

Table L4. Pollen Results.

Catalog Number	CLES #	*Pinus*	*Juniperus*	*Quercus*	Poaceae	Cheno-am	Aster h.s.	Aster l.s.
				Raw Pollen Counts				
7483-g488-363-1	92228	5	–	1	2	18	4	1
7483-g488-363-2	92227	2	–	–	4	8	1	3
7483-g488-363-3	92226	7	–	–	2	2	4	–
7483-g488-363-4	92225	19	1	1	8	23	3	–
7483-g488-363-5	92232	3	–	–	3	18	1	2
7483-g488-363-6	92229	4	1	–	1	8	1	–
7483-g488-363-7	92230	3	–	–	–	14	–	2
7483-g488-363-8	92231	1	–	–	–	7	–	–
7483-g492-363-1	92380	–	–	–	1	5	1	4
7483-g492-363-2	92377	2	–	–	1	1	–	–
7483-g492-363-3	92378	3	–	–	1	14	1	1
7483-g492-363-4	92379	6	–	–	–	1	–	–
				Pollen Concentration Values				
7483-g488-363-1	92228	139	0	28	56	502	111	28
7483-g488-363-2	92227	57	0	0	114	227	28	85
7483-g488-363-3	92226	175	0	0	50	50	100	0
7483-g488-363-4	92225	530	28	28	223	641	84	0
7483-g488-363-5	92232	68	0	0	68	408	23	45
7483-g488-363-6	92229	105	26	0	26	211	26	0
7483-g488-363-7	92230	82	0	0	0	383	0	55
7483-g488-363-8	92231	24	0	0	0	169	0	0
7483-g492-363-1	92380	0	0	0	21	107	21	85
7483-g492-363-2	92377	46	0	0	23	23	0	0
7483-g492-363-3	92378	69	0	0	23	322	23	23
7483-g492-363-4	92379	155	0	0	0	26	0	0

Table L5. Pollen Results.

Catalog Number	CLES	*Arte-misia*	*Platy-opuntia*	Cactaceae	*Ephedra*	*Zea mays*	Indeter-minate	Marker	Trans	Sum	% Indeter.	Con.
						Raw Pollen Counts						
g488 363 1	92228	–	–	1	–	–	9	52	4	41	0.220	1,143
g488 363 2	92227	–	–	1	–	–	7	51	7	26	0.269	739
g488 363 3	92226	–	–	–	–	–	4	58	20	19	0.211	475
g488 363 4	92225	–	–	–	3	–	15	52	3	73	0.205	2,035
g488 363 5	92232	1	–	–	–	–	8	64	4	36	0.222	815
g488 363 6	92229	–	–	–	–	–	4	55	3	19	0.211	501
g488 363 7	92230	–	–	–	–	–	7	53	4	26	0.269	711
g488 363 8	92231	–	–	–	–	–	8	60	5	16	0.500	386
g492 363 1	92380	1	–	–	–	–	3	68	3	15	0.220	320
g492 363 2	92377	–	–	–	–	–	11	63	4	15	0.733	345
g492 363 3	92378	6	1	–	–	–	22	63	3	49	0.449	1,127
g492 363 4	92379	–	–	–	–	1	3	56	7	11	0.273	285
						Pollen Concentration Values						
g488 363 1	92228	0	0	28	0	0	251	52	4	41	0.220	1,143
g488 363 2	92227	0	0	28	0	0	199	51	7	26	0.269	739
g488 363 3	92226	0	0	0	0	0	100	58	20	19	0.211	475
g488 363 4	92225	0	0	0	84	0	418	52	3	73	0.205	2,035
g488 363 5	92232	23	0	0	0	0	181	64	4	36	0.222	815
g488 363 6	92229	0	0	0	0	0	105	55	3	19	0.211	501
g488 363 7	92230	0	0	0	0	0	191	53	4	26	0.269	711
g488 363 8	92231	0	0	0	0	0	193	60	5	16	0.500	386
g492 363 1	92380	21	0	0	0	0	43	68	3	15	0.200	320
g492 363 2	92377	0	0	0	0	0	253	63	4	15	0.733	345
g492 363 3	92378	138	23	0	0	0	506	63	3	49	0.449	1,127
g492 363 4	92379	0	0	0	0	26	78	56	7	11	0.273	285

Appendix M

CHARCOAL FROM MANEUVER AREA I SITES FORT BLISS, TEXAS (Project 90-11)

by
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Methods: Each piece of charcoal was snapped to expose a fresh transverse section that was examined with side lighting with a binocular microscope at 10 to 50 power. Identification, when necessary, was aided by reference to a comparative collection of carbonized woods from known species.

Results: As Table M1 demonstrates, only woody angiosperms were identified in the samples. Some difficulty was had in working with the generally small size of the specimens, as evident in the number of unidentifiable specimens, the number for which only vessel patterns could be obtained, and the number questionably identified to specific taxa.

Table M1. Identified Charcoal.

FB Site Number	FB Catalog	Feature	CN	*Prosopis glandulosa*	Unidentified angiosperm	Other
6741	1344	2	1094	1	–	
7483	241	19	433	8	2	
7483	244-1	36	611	3	–	
7483	244-2	36	593	2 + 1 cf.	1	
7483	244-3	36	722	2	–	
7483	364-1	13	535	6	–	
7483	364-2	13	714	2 + 1 cf.	1	
7483	451	43	820	8 + 2 cf.	3	
7483	457	43	826	22 + 2 cf.	2	
7508	80-1	7	115	3 + 1 cf.	–	

Notes:
Cf. = "closely follows"; specimen compares well with reference material but is either too small or in too poor a condition for certain identification. For the Prosopis *material, I would not object to grouping it all in a single count. The other cf. specimens are more questionable and should be left as indicated.*
Unidentifiable angiosperms = woody flowering plants; not gymnosperms (juniper, pine, etc.); definitely not oak or Populus*; these specimens were mostly too small for identification or included branching or knots where the pattern of vessels and rays was not clear or a few specimens with exploded vessels and tissue such that identification was hazardous.*
Ring porous, semidiffuse porous, diffuse porous = these refer to the pattern of vessels in woody angiosperms that could not be identified to a more specific taxa; they were in better shape than the unidentifiable specimens but still were weathered or small enough to make a more specific identification questionable.

(Continued on next page.)

Table M1. Identified Charcoal (continued).

FB Site Number	FB Catalog	Feature	CN	*Prosopis glandulosa*	Unidentified angiosperm	Other
7508	80-2	7	114	5 + 1 cf.	1	
7510	726	0	865	4 + 1 cf.	1	
7510	728	40	859	7 + 3 cf.	–	
7510	729	38	852	3 + 2 cf.	–	
10411	119	16	144	3	–	
10411	124	16	157	2	–	
10411	134	16	169	1	–	1 ring porous
10411	166	11	166	1 cf.	1	
10411	254	16	232	2 + 1 cf.	2	
12069	135	14	171	–	–	1 *Atriplex canescens*
12069	144	16	201	1 + 2 cf.	1	
12069	147	16	208	1	–	
12069	148	16	210	12 + 3 cf.	–	15 not analyzed
12069	152	16	225	2	–	
12069	156	16	196	1 + 1 cf.	2	
12069	158	16	235	2	–	
12069	162	16, 20, 22	248	6 + 3 cf.	–	1 cf. *Atriplex canescens*
12069	186	22	241	4	–	
12072	50-1	6	56	6	2	
12072	50-2	6	57	6 + 1 cf.	–	
12072	70	6	114	3 + 1 cf.	–	1 diffuse porous
12072	72	15	116	1 + 3 cf.	6	
12072	75-1	15	121	7 + 1 cf.	2	1 ring porous
12072	75-2	15	122	6	–	
12072	80-1	20	133	5 + 1 cf.	1	1 cf. *Atriplex canescens*
12072	80-2	20	134	3	–	
12072	81	15	136	7	1	
12072	82	20	139	4 + 1 cf.	1	
12072	83-1	15	137	2	–	
12072	83-2	15	138	4 + 2 cf.	–	
12072	85-1	20	141	7 + 2 cf.	1	
12072	85-2	20	142	10 + 1 cf.	–	1 diffuse porous
12100	114	27	909	4 + 1 cf.	2	
12100	256	32	861	8 + 4 cf.	4	

(Continued on next page.)

Table M1. Identified Charcoal (continued).

FB Site Number	FB Catalog	Feature	CN	*Prosopis glandulosa*	Unidentified angiosperm	Other
12100	262	27	865	10	–	3 *Larrea divaricata*, 2 diffuse porous
12100	264	27	869	10 + 2 cf.	–	1 semi-diffuse porous
12100	274	27	896	4	–	1 diffuse porous
12100	276	27	898	4	–	
12100	297	39	931	4 + 1 cf.	–	3 cf. *Atriplex canescens*
12100	300	41	920	2	–	1 *Atriplex*
12100	305	47	926	3 + 1 cf.	2	1 cf. *Larrea divaricata*
12100	307	49	930	2 cf.	–	
12100	310	34	911	1	–	
12102	145	3	69	2 + 1 cf.	–	
12330	18	3	22	5	–	
12330	128-1	7	172	27 + 1 cf.	–	2 cf. *Atriplex canescens*
12330	172	6	84	2 cf.	–	
12330	173	7	161	11	–	

Little diversity was noted in the samples, and species representation followed that for other studies of lowland desert sites. Mesquite comprised most of the material, and much of the unidentifiable material is probably mesquite. Similarly, specimens noted only for vessel form are probably mesquite—young individuals, pith, etc.—but different enough from comparative specimens to warrant a separate distinction. Some four-wing saltbush and creosote bush were among the material.

While *Populus* sp. and *Pinus* sp. were noted in flotation samples from one of the sites, neither species was identified in the material studied. Special care was taken even with the smallest specimens to insure that identification was accurate. Pines and other gymnosperms are quite distinctive and could not have been mistaken for mesquite or one of the other identified plants. The same can be said of aspen or cottonwood, though these poplar species are angiosperms and have a vessel size and distribution similar to creosote bush. Attention was also given to insure that no specimen of oak would be missed. Oak has a very distinctive ray pattern but was not noted in any of the identified or unidentified specimens. Thus, there would appear to be little difference in the wood utilized in features of the study area and through the represented time.

Appendix N

Radiocarbon Dates

Compiled by Tim Graves

A total of 105 radiocarbon samples from a variety of Project 90-11 contexts was run by Beta Analytic, Inc., Coral Gables, Florida. These samples included eleven assays on wood collected from site surfaces, one charcoal sample from a modern hearth, one soil sample, and one sample of calcium carbonate nodules. The remaining samples were from archaeological features in the project area. Table N1 provides a listing of the samples along with the ^{14}C age and the ^{13}C adjusted age. The original sample sheets are on file at the Directorate of Environment, Conservation Division, Fort Bliss, Texas.

Table N1. Radiocarbon Samples and Results from Project 90-11.

FB Site No.	Feature	East	North	Level	Beta Number	Material	^{14}C Age (B.P.)	^{13}C Adjusted Age (B.P.)
6741	–	–	–	0	53410	Wood	110 ± 50	90 ± 50
6741	–	–	–	0	53411	Wood	160 ± 50	110 ± 50
6741	–	–	–	0	53412	Wood	Modern	Modern
6741	–	–	–	0	53413	Wood	360 ± 50	350 ± 50
6741	–	–	–	0	54062	Wood	10 ± 60	10 ± 60
6741	–	–	–	0	53414	Wood	40 ± 60	30 ± 60
6741	–	–	–	0	53415	Wood	120 ± 70	110 ± 70
6741	–	–	–	0	53416	Wood	Modern	Modern
6741	–	–	–	0	53417	Wood	Modern	Modern
6741	–	–	–	0	53418	Wood	Modern	Modern
6741	7	194	147	1	43195	Charcoal	2310 ± 50	2270 ± 50
6741	135	308	132	2	50086	Charcoal	4020 ± 70	4010 ± 70
6741	135	308	132	2	50087	Charcoal	3940 ± 80	3950 ± 80
6741	152	192	148	1	43196	Charcoal	2310 ± 80	2330 ± 80
7483	–	–	–	0	53419	Wood	140 ± 70	130 ± 70
7483	–	–	–	–	58411	Carbonate	15870 ± 100	16250 ± 100
7483	–	–	–	–	58412	Soil	780 ± 100	880 ± 100
7483	6	171	137	3	39505	Charcoal	2070 ± 80	2060 ± 80
7483	12	202	88	2	39506	Charcoal	3080 ± 90	3090 ± 90
7483	13	170	231	2	39501	Charcoal	1520 ± 60	1530 ± 60
7483	14	172	236	2	39500	Charcoal	1640 ± 70	1620 ± 70
7483	16	192	94	2	39504	Charcoal	6290 ± 110	6290 ± 110
7483	19	114	63	2	39499	Charcoal	2850 ± 60	2840 ± 60
7483	19	114	63	2	53357	Charcoal	2920 ± 50	2930 ± 50
7483	32	108	44	2	39503	Charcoal	3100 ± 90	3090 ± 90

(Continued on next page.)

Table N1. Radiocarbon Samples and Results from Project 90-11 (continued).

FB Site No.	Feature	East	North	Level	Beta Number	Material	^{14}C Age (B.P.)	^{13}C Adjusted Age (B.P.)
7483	36	171	234	2	39502	Charcoal	1620 ± 50	1610 ± 50
7483	38	169	227	2	50088	Charcoal	1410 ± 50	1400 ± 50
7483	38	169	227	2	50089	Charcoal	1520 ± 50	1500 ± 50
7483	43	147	121	2	39507	Charcoal	1640 ± 80	1650 ± 80
7483	43	147	121	3	50090	Charcoal	2560 ± 50	2570 ± 50
7483	43	147	121	3	50091	Charcoal	2730 ± 70	2730 ± 70
7483	43	147	121	4	53359	Charcoal	2460 ± 50	2450 ± 50
7483	43	147	121	4	53360	Charcoal	2480 ± 60	2480 ± 60
7483	43	147	120	4	53358	Charcoal	2470 ± 60	2470 ± 60
7483	44	145	118	2	53361	Charcoal	3280 ± 80	3280 ± 80
7483	44	145	118	2	53362	Charcoal	3180 ± 70	3170 ± 70
7508	7	203	141	1	43194	Charcoal	3800 ± 60	3780 ± 60
7510	38	515	546	2	47931	Charcoal	1520 ± 50	1530 ± 50
7510	38	515	546	2	47932	Charcoal	1400 ± 50	1390 ± 50
7510	39	523	555	1	53363	Charcoal	2250 ± 60	2250 ± 60
7510	40	522	549	2	47933	Charcoal	1590 ± 50	1600 ± 50
7510	40	522	549	2	47934	Charcoal	1490 ± 50	1500 ± 50
7510	68	477	615	1	43197	Charcoal	1910 ± 60	1910 ± 60
7510	74	515	547	2	47935	Charcoal	1500 ± 60	1500 ± 60
7510	74	515	547	2	47936	Charcoal	1470 ± 60	1480 ± 60
7517	45	245	192	2	43198	Charcoal	2430 ± 50	2430 ± 50
7520	2	80	426	1	50092	Charcoal	5620 ± 80	5620 ± 80
7547	3	480	183	2	43199	Charcoal	2420 ± 60	2440 ± 60
7547	54	376	498	2	50093	Charcoal	1410 ± 60	1420 ± 60
7547	86	310	746	2	43200	Charcoal	2200 ± 70	2210 ± 70
7580	4	381	469	2	50094	Charcoal	1820 ± 50	1820 ± 50
7580	6	370	479	2	43193	Charcoal	2810 ± 60	2800 ± 60
7580	8	369	483	2	47937	Charcoal	2870 ± 60	2860 ± 60
7580	8	369	483	2	47938	Charcoal	2830 ± 60	2820 ± 60
7580	26	370	476	2	43201	Charcoal	2410 ± 80	2410 ± 80
10411	16	187	175	6	43202	Charcoal	690 ± 70	80 ± 70
10411	17	195	203	1	47939	Charcoal	880 ± 60	860 ± 60
11299	9	228	171	2	47940	Charcoal	820 ± 50	810 ± 50
12069	7	179	231	2	43203	Charcoal	1510 ± 70	1510 ± 70
12069	15	314	193	2	43204	Charcoal	1480 ± 50	1490 ± 50
12069	16	315	192	2	47942	Charcoal	1460 ± 70	1460 ± 70
12069	16	315	192	2	47943	Charcoal	1550 ± 60	1540 ± 60
12069	16	314	191	2	50097	Charcoal	1720 ± 60	1720 ± 60
12069	16	314	191	2	50098	Charcoal	1540 ± 50	1550 ± 50

(Continued on next page.)

Table N1. Radiocarbon Samples and Results from Project 90-11 (continued).

FB Site No.	Feature	East	North	Level	Beta Number	Material	^{14}C Age (B.P.)	^{13}C Adjusted Age (B.P.)
12069	18	312	189	2	50096	Charcoal	1590 ± 60	1600 ± 60
12069	22	313	190	3	50095	Charcoal	1390 ± 70	1390 ± 70
12072	6	399	423	2	43205	Charcoal	1910 ± 50	1930 ± 50
12072	6	399	422	2	50099	Charcoal	1640 ± 50	1640 ± 50
12072	6	399	422	2	53364	Charcoal	1940 ± 50	1930 ± 50
12072	12	507	350	1	43209	Charcoal	240 ± 70	270 ± 70
12072	15	401	422	2	43207	Charcoal	2020 ± 80	2040 ± 80
12072	15	401	422	3	43208	Charcoal	2010 ± 90	2020 ± 90
12072	15	402	422	3	50100	Charcoal	1920 ± 60	1920 ± 60
12072	15	401	421	2	53366	Charcoal	1870 ± 50	1870 ± 50
12072	15	401	421	2	53367	Charcoal	1770 ± 60	1790 ± 60
12072	17	399	422	2	43206	Charcoal	1900 ± 40	1920 ± 40
12072	20	401	421	3	50101	Charcoal	1900 ± 60	1890 ± 60
12072	20	401	421	3	53365	Charcoal	1900 ± 70	1910 ± 70
12072	20	402	421	3	50102	Charcoal	1890 ± 50	1890 ± 50
12100	7	293	376	4	39508	Charcoal	1350 ± 90	1350 ± 90
12100	9/44	177	367	3	50106	Charcoal	1000 ± 60	1010 ± 60
12100	31	183	367	0	50103	Charcoal	1140 ± 50	1150 ± 50
12100	32	183	367	2	50104	Charcoal	1100 ± 50	1110 ± 50
12100	42	177	367	3	50105	Charcoal	1020 ± 60	1010 ± 60
12100	46	177	367	3	50107	Charcoal	1090 ± 50	1110 ± 50
12102	3	142	60	2	39509	Charcoal	2400 ± 60	2400 ± 60
12102	9	143	117	1	39510	Charcoal	1700 ± 120	1710 ± 120
12218	4	170	105	1	39511	Charcoal	2180 ± 80	2190 ± 80
12224	4	237	168	2	43210	Charcoal	3770 ± 60	3790 ± 60
12225	1	98	91	1	43211	Charcoal	2920 ± 90	2930 ± 90
12225	1	98	92	1	50108	Charcoal	2850 ± 100	2850 ± 100
12225	2	98	95	2	50109	Charcoal	2910 ± 60	2920 ± 60
12243	1	214	228	2	43213	Charcoal	2700 ± 60	2710 ± 60
12316	9	175	188	1	47944	Charcoal	2410 ± 70	2410 ± 70
12319	2	203	220	2	50110	Charcoal	1850 ± 60	1850 ± 60
12330	1	329	283	2	50111	Charcoal	1390 ± 50	1400 ± 50
12330	2	315	265	1	50112	Charcoal	2000 ± 60	2020 ± 60
12330	3	330	281	2	50113	Charcoal	1510 ± 60	1520 ± 60
12330	3	330	281	2	43212	Charcoal	1440 ± 50	1440 ± 50
12330	6	322	302	1	50114	Charcoal	2000 ± 60	2010 ± 60
12330	7	326	328	6	47946	Charcoal	1300 ± 70	1290 ± 70
12330	7	326	328	6	53368	Charcoal	980 ± 50	1050 ± 50
12330	7	326	327	6	47945	Charcoal	1130 ± 70	1140 ± 70
12331	3	97	99	2	50115	Charcoal	2070 ± 60	2060 ± 60
Experimental Hearth					54063	Charcoal	Modern	Modern

Appendix O

Hydration Analysis of Obsidian Artifacts from Sites on Project 90-11, Ft Bliss, Texas

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A total of 128 obsidian artifacts was submitted to Diffusion Laboratory for age determination using the obsidian hydration dating method; 115 were from surface and 13 were from subsurface contexts (2 to 30 centimeters). The artifacts were from sites on Project 90-11 on Fort Bliss military reservation.

To calculate an absolute date for an obsidian artifact four analytical procedures need to be completed. First, the amount of surface hydration, or thickness of the hydration rim, must be measured. Second, the geological origin of the artifact needs to be ascertained so that the set of rate constants particular to each glass type may be applied. Third, the hydration rate constants for each chemically distinct natural glass are determined. Lastly, the soil temperature (EHT) and relative humidity (RH) at the archaeological site is estimated so the rate of hydration at high temperature may be adjusted to reflect the hydration temperature at the prehistoric site.

Hydration Rim Measurement

A thin section was prepared for each sample under the guidelines presented by Michels and Bebrich (1971). Hydration rim width measurements were made at 800x using a Watson image-splitting measurement instrument (Scheetz and Stevenson 1988). Seven independent measurements were made and the mean value and standard deviation were calculated. The standard deviations represent the precision errors associated with the measurement process. An estimated accuracy of 0.1 um was used to determine the uncertainty factor for each age determination.

Compositional Analysis

In south-central New Mexico, the only known obsidian raw material occurs as detrital fragments contained within the Cenozoic deposits of the ancestral Rio Grande. The original extrusion points for the majority of these glasses are in the Jemez Mountain region or at East Grants Ridge (Stevenson and McCurry 1990). Subsequent erosion of the high silica rhyolite flows resulted in the transport and deposition of material as far south as El Paso, Texas, and possibly much further. This process resulted in the emplacement of glasses from numerous sources to the same location in southern New Mexico and Texas, where they were utilized by prehistoric peoples. As a consequence, chemically distinct obsidians with different rates of hydration may be present at a site. The situation requires that each of the artifacts be chemically analyzed to determine the geologic source. Once completed, the appropriate rate constants may then be applied.

In this analysis trace element analysis was not conducted. Rather, the artifacts were visually examined to determine the most likely geological source. Dark black and gray glasses were omitted from the sample. Only samples that had a smoky appearance were submitted. This obsidian is thought to originate only from the Obsidian Ridge source.

Hydration Rate Development

The hydration rate for Obsidian Ridge has been developed in the laboratory. Under conditions of high temperature and pressure (Stevenson et al. 1989) freshly fractured flakes were hydrated in a silica saturated solution between temperatures of 140 degrees C and 170 degrees C for periods of up to 31 days. At the end of the reaction periods each sample was thin sectioned and the hydration rim measured. The induced rims were used to calculate the activation energy (81785 J/mol) and the preexponential (2.16 at 160 degrees C).

Soil Temperature Relative Humidity Estimations

Soil temperature and soil relative humidity significantly affect the rate of hydration (Mazer et al. 1991). These data are available for the project areas and were used to adjust the laboratory rate to reflect the environmental conditions at the archaeological site.

Monitoring of soil contexts at prehistoric sites on Fort Bliss was completed in September 1991. At a nearby location a surface EHT of 22.97 degrees C was obtained using environmental monitoring cells. A relative humidity of 30 percent was also recorded and was used to adjust the laboratory rate. This resulted in a rate reduction of 25 percent (Mazer et al. 1991). A temperature of 21.52 degrees C was obtained at a depth of 10 centimeters and a temperature of 20.54 degrees C was obtained at 30 centimeters using environmental monitoring cells. Since the subsurface artifacts were recovered from a depth of 2 to 30 centimeters an average temperature of 20.88 degrees C was used for the samples. A relative humidity of 90 percent was used to adjust the laboratory rate. This resulted in a rate reduction of 25 percent (Mazer et al. 1991).

Age Estimation

Using the estimated effective hydration temperatures and relative humidities, a hydration rate for Obsidian Ridge was calculated. The high temperature hydration rate (160 degrees C) was adjusted to reflect the estimated EHT and RH for the project area using the Arrhenius equation:

$$K = (RH)k' \text{ EXP } E/RT$$

where K = archaeological hydration rate (um square/day)
Rh = relative humidity adjustment (0.75 percent)
k′ = preexponential (um square/day at 160 degrees C)
E = activation energy (J/mol)
R = universal gas constant
T = effective hydration temperature in degrees Kelvin

This resulted in a hydration rate of 16.21 um squared /1,000 years for the surface Obsidian Ridge glass and a rate of 12.81 um squared /1,000 years for subsurface specimens. Table O1 presents the results for the surface samples, and Table O2 presents the subsurface results.

Table O1. Surface Obsidian From Project 90-11.

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
DL-92-15	6741-G711-211	OR	1.88	0.04	A.D. 1774	24
DL-92-16	6741-G1663-211	OR	4.70	0.06	A.D. 629	58
DL-92-17	6741-G1073-211	OR	3.19	0.05	A.D. 1364	40
DL-92-18	6741-G183-211	OR	4.47	0.05	A.D. 759	56
DL-92-19	6741-G201-211	OR	2.34	0.04	A.D. 1654	29
DL-92-20	6741-G1362-211	OR	3.99	0.05	A.D. 1010	50
DL-92-21	6741-G1109-211	OR	3.91	0.04	A.D. 1049	49
			3.47	0.05	A.D. 1249	43
DL-92-22	6741-G1062-211	OR	5.28	0.04	A.D. 272	66
			4.17	0.05	A.D. 919	52
DL-92-23	6741-G771-211	OR	2.11	0.05	A.D. 1717	27
DL-92-24	6741-G790-211	OR	6.31	0.05	464 B.C.	78
DL-92-25	6741-G114-211	OR	3.96	0.05	A.D. 1024	49
DL-92-358	6741-G90-211	OR	3.16	0.07	A.D. 1333	40
DL-92-359	6741-G157-211	OR	3.12	0.07	A.D. 1349	39
DL-92-360	6741-G193-211	OR	3.88	0.09	A.D. 1021	48
DL-92-361	6741-G432-211	OR	5.25	0.05	A.D. 250	65
DL-92-362	6741-G626-211	OR	2.87	0.05	A.D. 1441	36
DL-92-363	6741-G748-211	OR	2.98	0.05	A.D. 1402	37
DL-92-364	6741-G918-211	OR	2.95	0.05	A.D. 1413	37
DL-92-365	6741-G1851-211	OR	3.56	0.05	A.D. 1168	44
DL-92-366	7483-G80-207	OR	6.12	0.05	361 B.C.	76
DL-92-367	7484-G37-211	OR	3.96	0.05	A.D. 983	49
DL-92-368	7484-G44-261	OR	3.02	0.04	A.D. 1387	38
DL-92-369	7484-G72-211	OR	6.13	0.08	368 B.C.	76
DL-92-370	7484-G84-211	OR	5.11	0.07	A.D. 339	64
DL-92-371	7484-G93-213	OR	3.02	0.04	A.D. 1387	38
DL-92-372	7484-G95-211	OR	6.72	0.05	836 B.C.	84
DL-92-373	7484-G168-261	OR	5.59	0.08	A.D. 22	70
DL-92-374	7484-G190-207	OR	5.91	0.05	204 B.C.	73
DL-92-375	7484-G232-211	OR	2.14	0.07	A.D. 1667	27
DL-92-376	7484-G250-211	OR	7.27	0.07	1310 B.C.	90
DL-92-40	7484-G21-211	OR	3.09	0.05	A.D. 1403	39
DL-92-45	7484-G113-211	OR	2.98	0.05	A.D. 1444	37
DL-92-46	7508-G41-211	OR	5.14	0.08	362 A.D.	64
DL-92-377	7510-G72-211	OR	No Rim			
DL-92-378	7510-G78-261	OR	4.94	0.05	A.D. 444	62

(Continued on next page.)

Table O1. Surface Obsidian From Project 90-11 (continued).

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
DL-92-379	7510-G109-211	OR	2.90	0.05	A.D. 1431	37
			3.60	0.08	A.D. 1150	45
DL-92-380	7510-G111-211	OR	3.65	0.05	A.D. 1128	46
DL-92-381	7510-G122-211	OR	3.54	0.04	A.D. 1177	44
DL-92-382	7510-G132-211	OR	2.97	0.05	A.D. 1406	37
DL-92-383	7510-G133-211	OR	2.97	0.05	A.D. 1406	37
DL-92-384	7510-G150-211	OR	10.43	0.08	4760 B.C.	129
DL-92-385	7510-G159-211	OR	3.89	0.07	A.D. 1016	49
DL-92-386	7510-G178-211	OR	3.74	0.07	A.D. 1087	47
DL-92-387	7510-G236-213	OR	3.84	0.07	A.D. 1040	48
DL-92-1	7510-G185-211	OR	3.16	0.05	A.D. 1375	40
DL-92-2	7510-G255-211	OR	2.65	0.04	A.D. 1558	33
DL-92-3	7510-G107-211	OR	3.28	0.08	A.D. 1328	41
DL-92-4	7510-G249-211	OR	No Rim			
DL-92-5	7510-G496-211	OR	3.99	0.05	A.D. 1010	50
DL-92-6	7510-G108-211	OR	8.60	0.10	2570 B.C.	107
DL-92-7	7510-G506-211	OR	6.24	0.05	410 B.C.	78
			2.38	0.05	A.D. 1642	30
DL-92-8	7510-G531-211	OR	1.97	0.04	A.D. 1752	25
DL-92-9	7510-G484-211	OR	2.60	0.05	A.D. 1575	33
DL-92-10	7510-G526-207	OR	4.07	0.05	A.D. 970	51
			3.02	0.04	A.D. 1429	38
DL-92-44	7517-G5-211	OR	4.96	0.05	A.D. 474	62
DL-92-11	7520-G196-211	OR	3.40	0.05	A.D. 1278	43
DL-92-12	7520-G111-211	OR	7.15	0.08	1161 B.C.	89
DL-92-13	7520-G417-211	OR	3.02	0.04	A.D. 1429	36
			2.20	0.05	A.D. 1693	28
DL-92-14	7520-G182-211	OR	2.58	0.05	A.D. 1581	32
			1.65	0.04	A.D. 1824	21
DL-92-388	7520-G169-211	OR	6.78	0.07	886 B.C.	84
DL-92-389	7520-G383-211	OR	2.51	0.05	A.D. 1561	32
DL-92-390	7520-G405-207	OR	2.60	0.05	A.D. 1533	33
DL-92-391	7547-G107-261	OR	No Rim			
DL-92-392	7547-G477-211	OR	6.37	0.06	553 B.C.	79
DL-92-393	7547-G483-213	OR	2.74	0.06	A.D. 1487	34
DL-92-26	7547-G125-211	OR	9.11	0.08	3128 B.C.	113
			7.73	0.09	1694 B.C.	96

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Table O1. Surface Obsidian From Project 90-11 (continued).

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
DL-92-27	7547-G132-211	OR	4.34	0.07	A.D. 830	54
			3.51	0.04	A.D. 1232	44
DL-92-28	7547-G135-211	OR	7.77	0.07	1732 B.C.	96
DL-92-29	7547-G276-211	OR	6.78	0.07	844 B.C.	84
DL-92-30	7547-G208-211	OR	4.06	0.05	A.D. 975	51
			2.98	0.05	A.D. 1444	37
DL-92-394	7569-G53-211	OR	2.97	0.05	1405 A.D.	37
DL-92-395	7583-G13-211	OR	No Rim			
DL-92-396	7583-G13-261	OR	No Rim			
DL-92-397	7583-G22-207	OR	2.53	0.05	A.D. 1555	32
DL-92-37	10410-G37-211	OR	4.19	0.05	A.D. 909	52
			3.11	0.07	A.D. 1395	39
DL-92-420	11299-G19-211	OR	2.76	0.07	A.D. 1480	35
DL-92-421	11299-G34-211	OR	3.88	0.08	A.D. 1021	48
DL-92-422	11299-G37-211	OR	2.56	0.07	A.D. 1545	32
DL-92-39	11299-G17-211	OR	2.65	0.06	A.D. 1559	33
DL-92-398	12069-G60-211	OR	5.24	0.05	A.D. 256	65
DL-92-399	12069-G70-211	OR	No Rim			
DL-92-400	12069-G74-211	OR	5.84	0.08	153 B.C.	73
			3.93	0.04	A.D. 997	50
DL-92-401	12069-G95-211	OR	7.07	0.07	1134 B.C.	88
			5.38	0.07	A.D. 164	67
DL-92-402	12072-G16-211	OR	2.59	0.08	A.D. 1536	32
DL-92-50	12102-G37-211	OR	2.83	0.04	A.D. 1498	36
DL-92-47	12214-G18-211-2	OR	4.83	0.05	A.D. 553	60
			3.19	0.05	A.D. 1364	40
DL-92-48	12214-G5-211	OR	2.87	0.07	A.D. 1484	36
DL-92-49	12214-G4-211	OR	4.89	0.07	A.D. 516	61
DL-92-403	12217-G13-207	OR	2.93	0.07	A.D. 1420	37
DL-92-404	12221-G9-211	OR	4.34	0.07	A.D. 788	54
DL-92-405	12221-G6-211	OR	2.98	0.08	A.D. 1402	37
DL-92-406	12221-G7-211	OR	2.62	0.07	A.D. 1526	33
DL-92-42	12222-G2-201	OR	3.86	0.05	A.D. 1073	48
DL-92-31	12229-G130-211	OR	4.27	0.05	A.D. 867	53
			3.49	0.05	A.D. 1241	44
DL-92-32	12229-G88-207	OR	8.65	0.05	2624 B.C.	107
DL-92-33	12229-G38-211	OR	9.59	0.07	3681 B.C.	119

(Continued on next page.)

Table O1. Surface Obsidian From Project 90-11 (continued).

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
;DL-92-34	12229-G195-211-1	OR	No Rim			
DL-92-35	12229-G188-261	OR	No Rim			
DL-92-36	12229-G19-201	OR	No Rim			
DL-92-407	12229-G195-211	OR	3.19	0.05	A.D. 1322	40
DL-92-408	12229-G423-211	OR	3.07	0.05	A.D. 1368	28
			2.20	0.05	A.D. 1651	28
DL-92-409	12229-G424-211	OR	2.48	0.05	A.D. 1571	31
DL-92-410	12229-G477-211	OR	4.74	0.05	A.D. 564	59
DL-92-411	12229-G483-211	OR	5.73	0.05	75 B.C.	71
DL-92-412	12229-G643-211	OR	3.67	0.05	A.D. 1119	45
DL-92-413	12237-G11-211	OR	8.39	0.08	2393 B.C.	104
DL-92-414	12237-G48-211	OR	9.55	0.08	3676 B.C.	118
DL-92-38	12239-G90-211	OR	7.00	–	1031 B.C.	87
			4.14	0.05	A.D. 935	52
DL-92-415	12243-G29-211	OR	3.15	0.04	A.D. 1338	39
DL-92-43	12245-G27-201	OR	3.46	0.05	A.D. 1253	43
DL-92-41	12247-G11-211	OR	4.31	0.08	A.D. 846	54
			3.42	0.07	A.D. 1270	43
DL-92-416	12247-G50-211	OR	3.44	0.07	A.D. 1220	43
DL-92-418	12316-G24-211	OR	4.77	0.05	A.D. 546	59
			0.51	0.07	A.D.1190	44
DL-92-417	12316-G19-213	OR	3.98	0.05	A.D. 973	50
DL-92-419	12330-G26-211	OR	2.93	0.04	A.D.1420	37

Table O2. Subsurface Obsidian From Project 90-11.

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
DL-91-452	6741-G1381-211	OR	7.77	0.07	2721 B.C.	85
			5.81	0.07	644 B.C.	64
DL-91-462	6741-G1194-211	OR	4.17	0.05	A.D. 633	33
DL-91-463	6741-G1219-211	OR	2.65	0.08	A.D. 1443	34
DL-91-464	7483-G153-211	OR	4.21	0.08	A.D. 607	53
DL-91-461	7483-G159-211	OR	7.21	0.10	2067 B.C.	113
			5.31	0.07	210 B.C.	58
DL-91-453	7483-G233-211	OR	2.55	0.06	A.D. 1483	24
DL-91-454	7483-G236-213	OR	6.20	0.07	1010 B.C.	68
DL-91-459	12100-G120-211	OR	2.46	0.07	A.D. 1519	27
DL-91-460	12100-G123-211	OR	2.41	0.05	A.D. 1538	19

(Continued on next page.)

Table O2. Subsurface Obsidian From Project 90-11 (continued).

Lab No.	Provenience	Source	Width	S.D.	Date	S.D.
DL-91-455	12102-G108-211	OR	4.58	0.05	A.D. 353	36
			4.10	0.07	A.D.679	45
DL-91-456	12102-G84-211	OR	3.12	0.04	A.D. 1231	20
DL-91-457	12102-G76-211	OR	4.62	0.07	A.D. 325	51
			4.01	0.05	A.D. 735	51
DL-91-458	12102-G67-211	OR	4.44	0.05	A.D. 452	35

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Appendix P

REGRESSION DATES ON OBSIDIAN

FB Site #	Bag	Rim	B.P.	Calibrated Date	Period/Phase
6741	90	3.16	947.42	1002.58	Mesilla
6741	114	3.96	1270.44	679.56	Mesilla
6741	157	3.12	931.86	1018.14	Mesilla
6741	183	4.47	1487.13	462.87	Mesilla
6741	193	3.88	1237.18	712.82	Mesilla
6741	201	2.34	641.11	1308.89	El Paso
6741	432	5.25	1832.98	117.02	Late Archaic
6741	626	2.87	835.98	1114.02	Mesilla
6741	711	1.88	482.34	1467.66	Historic
6741	748	2.98	877.87	1072.13	Mesilla
6741	771	2.11	560.42	1389.58	El Paso
6741	790	6.31	2328.03	-378.03	Late Archaic
6741	918	2.95	866.40	1083.60	Mesilla
6741	1062	5.28	1846.61	103.39	Late Archaic
6741	1062	4.17	1358.71	591.29	Mesilla
6741	1073	3.19	959.13	990.87	Mesilla
6741	1109	3.91	1249.63	700.37	Mesilla
6741	1109	3.47	1069.99	880.01	Mesilla
6741	1194	4.17	1358.71	591.29	Mesilla
6741	1219	2.65	753.65	1196.35	El Paso
6741	1362	3.99	1282.96	667.04	Mesilla
6741	1381	7.77	3051.39	-1101.39	Late Archaic
6741	1381	5.81	2091.12	-141.12	Late Archaic
6741	1663	4.70	1587.37	362.63	Mesilla
6741	1663	2.91	851.16	1098.84	Mesilla
6741	1770	5.14	1783.21	166.79	Late Archaic
6741	1851	3.56	1106.20	843.80	Mesilla
7483	80	6.12	2237.31	-287.31	Late Archaic

Note: Negative dates represent B.C. dates.

(Continued on nest page.)

FB Site #	Bag	Rim	B.P.	Calibrated Date	Period/Phase
7483	153	4.21	1375.68	574.32	Mesilla
7483	159	7.21	2768.64	-818.64	Late Archaic
7483	159	5.31	1860.26	89.74	Late Archaic
7483	233	2.55	716.89	1233.11	El Paso
7483	236	6.20	2275.41	-325.41	Late Archaic
7484	21	3.09	920.23	1029.77	Mesilla
7484	37	3.96	1270.44	679.56	Mesilla
7484	44	3.02	893.22	1056.78	Mesilla
7484	72	6.13	2242.07	-292.07	Late Archaic
7484	84	5.11	1769.69	180.31	Late Archaic
7484	93	3.02	893.22	1056.78	Mesilla
7484	95	6.72	2526.56	-576.56	Late Archaic
7484	113	2.98	877.87	1072.13	Mesilla
7484	168	5.59	1988.77	-38.77	Late Archaic
7484	190	5.91	2138.03	-188.03	Late Archaic
7484	232	2.14	570.81	1379.19	El Paso
7484	250	7.27	2798.63	-848.63	Late Archaic
7508	41	5.14	1783.21	166.79	Late Archaic
7510	78	4.94	1693.54	256.46	Mesilla
7510	107	3.28	994.46	955.54	Mesilla
7510	108	8.60	3481.75	-1531.75	Late Archaic
7510	109	2.90	847.36	1102.64	Mesilla
7510	109	3.60	1122.39	827.61	Mesilla
7510	111	3.65	1142.70	807.30	Mesilla
7510	122	3.54	1098.13	851.87	Mesilla
7510	132	2.97	874.04	1075.96	Mesilla
7510	133	2.97	874.04	1075.96	Mesilla
7510	150	10.43	4474.24	-2524.24	Middle Archaic
7510	159	3.89	1241.32	708.68	Mesilla
7510	178	3.74	1179.46	770.54	Mesilla
7510	185	3.16	947.42	1002.58	Mesilla
7510	236	3.84	1220.62	729.38	Mesilla
7510	255	2.65	753.65	1196.35	El Paso

(Continued on nest page.)

FB Site #	Bag	Rim	B.P.	Calibrated Date	Period/Phase
7510	484	2.60	735.22	1214.78	El Paso
7510	496	3.99	1282.96	667.04	Mesilla
7510	506	6.24	2294.51	-344.51	Late Archaic
7510	506	2.38	655.39	1294.61	El Paso
7510	526	4.07	1316.51	633.49	Mesilla
7510	526	3.02	893.22	1056.78	Mesilla
7510	531	1.97	512.57	1437.43	El Paso
7517	5	4.96	1702.46	247.54	Late Archaic
7520	169	6.78	2555.93	-605.93	Late Archaic
7520	182	2.58	727.87	1222.13	El Paso
7520	182	1.65	407.08	1542.92	Historic
7520	196	3.40	1042.01	907.99	Mesilla
7520	383	2.51	702.31	1247.69	El Paso
7520	405	2.60	735.22	1214.78	El Paso
7520	417	3.00	885.54	1064.46	Mesilla
7520	417	2.20	591.70	1358.30	El Paso
7520	1111	7.15	2738.72	-788.72	Late Archaic
7547	125	9.11	3752.53	-1802.53	Late Archaic
7547	125	7.73	3030.98	-1080.98	Late Archaic
7547	132	4.34	1431.15	518.85	Mesilla
7547	132	3.51	1086.05	863.95	Mesilla
7547	135	7.77	3051.39	-1101.39	Late Archaic
7547	208	4.06	1312.30	637.70	Mesilla
7547	208	2.98	877.87	1072.13	Mesilla
7547	276	6.78	2555.93	-605.93	Late Archaic
7547	477	6.37	2356.85	-406.85	Late Archaic
7547	483	2.74	787.09	1162.91	El Paso
7569	53	2.97	874.04	1075.96	Mesilla
7583	22	2.53	709.59	1240.41	El Paso
10410	37	4.19	1367.19	582.81	Mesilla
10410	37	3.11	927.98	1022.02	Mesilla
11299	17	2.65	753.65	1196.35	El Paso
11299	19	2.76	794.57	1155.43	El Paso

(Continued on nest page.)

FB Site #	Bag	Rim	B.P.	Calibrated Date	Period/Phase
11299	34	3.88	1237.18	712.82	Mesilla
11299	37	2.56	720.55	1229.45	El Paso
12069	60	5.24	1828.44	121.56	Late Archaic
12069	74	5.84	2105.17	-155.17	Late Archaic
12069	74	3.93	1257.94	692.06	Mesilla
12069	95	7.07	2698.95	-748.95	Late Archaic
12069	95	5.38	1892.20	57.80	Late Archaic
12072	16	2.59	731.54	1218.46	El Paso
12100	120	2.46	684.17	1265.83	El Paso
12100	123	2.41	666.15	1283.85	El Paso
12102	37	2.83	820.87	1129.13	Mesilla
12102	67	4.44	1474.17	475.83	Mesilla
12102	76	4.62	1552.33	397.67	Mesilla
12102	76	4.01	1291.33	658.67	Mesilla
12102	84	3.12	931.86	1018.14	Mesilla
12102	108	4.58	1534.88	415.12	Mesilla
12102	108	4.10	1329.13	620.87	Mesilla
12102	132	3.44	1057.98	892.02	Mesilla
12214	4	4.89	1671.29	278.71	Mesilla
12214	5	2.87	835.98	1114.02	Mesilla
12214	18	4.83	1644.68	305.32	Mesilla
12214	18	3.19	959.13	990.87	Mesilla
12217	13	2.93	858.77	1091.23	Mesilla
12221	6	2.98	877.87	1072.13	Mesilla
12221	7	2.62	742.58	1207.42	El Paso
12221	9	4.34	1431.15	518.85	Mesilla
12222	2	3.86	1228.89	721.11	Mesilla
12229	38	9.59	4011.57	-2061.57	Middle Archaic
12229	88	8.65	3508.09	-1558.09	Late Archaic
12229	130	4.27	1401.22	548.78	Mesilla
12229	130	3.49	1078.01	871.99	Mesilla
12229	195	3.19	959.13	990.87	Mesilla
12229	423	3.07	912.49	1037.51	Mesilla

(Continued on nest page.)

FB Site #	Bag	Rim	B.P.	Calibrated Date	Period/Phase
12229	423	2.20	591.70	1358.30	El Paso
12229	424	2.48	691.41	1258.59	El Paso
12229	477	4.74	1604.95	345.05	Mesilla
12229	483	5.73	2053.77	-103.77	Late Archaic
12229	643	3.67	1150.84	799.16	Mesilla
12237	11	8.39	3371.63	-1421.63	Late Archaic
12237	48	9.55	3989.83	-2039.83	Middle Archaic
12239	90	7.00	2664.27	-714.27	Late Archaic
12239	90	4.14	1346.02	603.98	Mesilla
12243	29	3.15	943.53	1006.47	Mesilla
12245	27	3.46	1065.98	884.02	Mesilla
12247	11	4.31	1418.31	531.69	Mesilla
12247	11	3.42	1049.99	900.01	Mesilla
12247	50	3.44	1057.98	892.02	Mesilla
12316	19	3.98	1278.79	671.21	Mesilla
12316	24	4.77	1618.17	331.83	Mesilla
12316	24	3.51	1086.05	863.95	Mesilla
12330	26	2.93	858.77	1091.23	Mesilla
12330	84	2.45	680.56	1269.44	El Paso

APPENDIX Q

THERMOLUMINESCENCE SAMPLES

Thermoluminescence samples consisting of a piece of burned caliche and a soil sample were collected where possible. A total of 22 samples from 13 archaeological and 1 modern feature was submitted to the University of Missouri for analysis. All features selected have independent chronometric information; most have radiocarbon dates while one is clearly associated with El Paso Polychrome ceramics. The 13 features span roughly 2,850 years. These samples, then, should provide sufficient data to assess the potential utility of the technique. Unfortunately, the results of this analysis were not available for inclusion in this report. However, a list of the samples submitted along with locational and chronometric information is provided (Table Q1). Also included is information on the developmental stage of the caliche. It is not known at present if the stage information is important, but it was recorded nonetheless.

Table Q1. Thermoluminescence Samples.

FB Site #	Feature	East	North	Level	Caliche Stage	Est. Date B.P.
7483	6	171	137	1	0	2088
7483	6	172	137	1	4	2088
7483	36	171	234	1	3	1540
7483	36	171	234	1	3	1540
7483	38	168	227	2	3	1354
7510	38	515	546	1	3	1358
7510	74	515	517	2	3	1413
7547	86	310	746	2	3	2186
10411	9	185	184	1	3	650
12102	9	143	117	1	3	1635
12102	9	144	117	1	3	1635
12072	12	507	350	1	0	250
12100	7	294	377	1	0	1235
12100	7	294	377	1	0	1235
12100	7	294	377	1	0	1235
12330	3	330	282	2	0	1410
12330	3	330	282	2	0	1410
12243	1	214	228	2	0	2849
12243	1	214	228	2	3	2849
–	5	–	–	–	0	0
–	5	–	–	–	0	0
–	5	–	–	–	4	0